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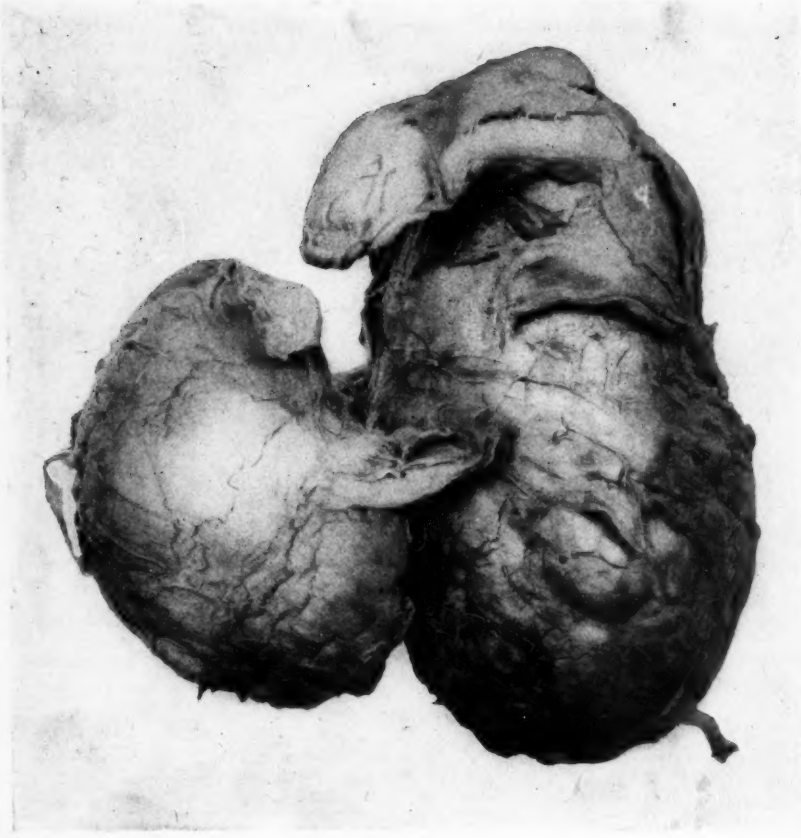
PLATE I. — Presented by DR. FRANCIS C. EDGERTON



The American Association of Genito-Urinary Surgeons

First Day, June 7th, 1912

EXHIBITION OF SPECIMEN OF ENORMOUS HYPERTROPHY OF THE PROSTATE

By Francis Cruger Edgerton, M. D., of New York City

THIS specimen I simply show on account of its size, and it would be interesting to me to hear the opinions of the different men as to the sizes of the prostates they have removed, and whether they could get one of this size out through the perineum or not.

The case is that of a man 64 years old, who had had more or less trouble with starting his stream, until about six weeks before I saw him, when he began to pass nothing but blood. At the time I saw the case I drew off forty ounces of very bloody urine. The man was in exceedingly poor condition. I did a quick suprapubic drainage, and when I put my finger through the wound I felt a mass as large as a grape fruit. I left the suprapubic tube in four days, and then gave him gas and removed the mass. It appears to me that when I removed it it was about twice the size it is now. I do not suppose that is quite true. It weighs 288 grams. Preserving it has shriveled it up considerably. The patient made a very satisfactory recovery, although it took about five weeks to heal up the suprapubic wound, as I had to drain him for four days, and his urine was in a very rotten condition at the time I drained him, and his resistance was exceedingly poor. But at the end of five weeks the wound had healed kindly.

DISCUSSION

Dr. Eugene Fuller, of New York: A prostate like the specimen shown, of such tremendously large size, is just the kind that the suprapubic operation is eminently fitted for. I suspect that this is of rather soft consistency. It must have had a very quick growth, and it probably could have been broken up and removed through the perineum. By taking it out suprapubically you disturb the bladder neck very little and the perineum not at all, whereas by taking a mass like that out through the perineum you are apt to so disturb the vesical neck that more or less dribbling and lack of vesical control not infrequently follows operations for a more or less prolonged period.

Dr. H. A. Fowler, of Washington: I was just comparing the size of this specimen with that of a prostate I removed some time ago. My specimen weighed 190 grams. It was removed by the suprapubic route with great ease. I am convinced that in cases of this kind where the prostate is very large and projects into the bladder, the suprapubic operation is ideal. Enucleation of the enlargement is simple, easy, and can be rapidly done. The amount of dissection necessary is minimal, and there is not so much danger of injuring the rectum as in the perineal operation. My patient was 79 years and 8 months old at the time of the operation. It has now been nearly two years and he is in good health and his bladder function is normal.

It is interesting to note that a few months previously I operated on the patient's brother, aged 74 years, removing almost as large a prostate through a suprapubic opening. The result in this case has been all that could be desired. I wish to add that in these two cases, as in all my suprapubic prostatectomies, I packed the cavity with plain gauze to control hæmorrhage. This packing is partially removed in twenty-four hours, and in forty-eight hours all packing is taken out. I have not seen the terrible suffering associated with this packing in the cavity or its removal which has been spoken of by some operators who advise against its use. And in these two cases referred to, the urine is absolutely clear and free from infection.

Dr. John H. Cunningham, Jr., of Boston: In defense of the perineal operation I must say a word, because the prostate which Dr. Edgerton has shown looks very much like one which I took out through a median perineal section. The specimen weighed eight ounces. The patient was 82 years old at the time, and, while the operation was done

eight years ago, one year ago he was still alive and had a good functional result.

I think this whole subject of the route by which to approach the prostate was summarized by Dr. Watson in his excellent monograph in 1888, when he showed that all the larger glands are best attacked from above, while the smaller ones are best removed from below. While I think that was the first real philosophy on the subject, it has not been generally comprehended, and some beginning surgeons, ignorant of that philosophy, have taken out really very large glands through the perineum, with good results.

Dr. Charles H. Chetwood, of New York: I think it is a very good rule to follow the practice of doing the operation in two stages, as Dr. Edgerton did in this case, when there is a very large prostate and a feeble subject. Such a course adds much to the patient's chances of recovery. The result, I think, might have been otherwise had it not been for that method of procedure.

Dr. Edgerton: The method I followed in removing this prostate is practically the same method Dr. Alexander used, only with a different approach. That is, I was taught by him to enter the urethra and break in above the growth and peel it out. That same method was followed here, only in approaching it suprapubically. In that way he used to claim that the line of cleavage was easily found and the gland peeled out with very little hæmorrhage. I felt if I should have enucleated it at the time of the first operation that I would probably have had severe hæmorrhage, and the patient would have stood it very poorly. At the time of the second operation it appeared to me that the tumor that I felt in the bladder had gone down considerably, the congestion having practically disappeared.

REPORT OF A CASE OF EXTIRPATION OF THE BLADDER FOR MALIGNANT DISEASE

By Francis R. Hagner, M. D., of Washington, D. C.

WHILE there are a number of cases of total extirpation of the bladder in the literature, the procedure is so radical and the results following it so interesting to observe, that I feel it might be of interest to report the present case, although the end result was unsuccessful.

L. F., age 40, a Russian, was seen by me the latter part of November, 1911, presenting the following history: hæmaturia of two years' duration, painful and gradually increasing frequency of urination. His urine was very offensive and filled with blood and pus. At times the urination would take place as often as every fifteen minutes, accompanied with great tenesmus, again it would not happen oftener than every one and one-half hours. The more frequent the urinations the greater the pain and tenesmus. Following the passage of the urine which during the last six months was always blood-tinged, there would be an escape of almost pure blood. The patient was cystoscoped November 28th. On rectal examination the prostate and seminal vesicles showed no evidence of malignant disease, being of normal size and shape. Bladder capacity 125 c. c. After the instillation of adrenalin a satisfactory cystoscopic examination could be made, and a large, irregularly shaped tumor with a broad base involving the entire base of the bladder was observed. The size of the base of the tumor was easily seen with a retrograde cystoscope. On December 5th a suprapubic cystotomy was performed under cocaine and adrenalin anæsthesia. At the time of operation the cystoscopic findings were confirmed, and a suprapubic drain was inserted and continuous irrigation employed. The patient was very much more comfortable after this operation and his general condition improved. As the patient was in fairly good condition, the gravity of the case

was explained to him and he was advised to have the operation as advocated by Dr. Watson of Boston, namely, double nephrostomy with continuous drainage of the kidneys and subsequent removal of the bladder. The patient refused this operation as he said he did not wish his urine running out of his back. It was then explained that the ureters could be transplanted into his rectum. This he decided to have done.

He was operated December 15th under nitrous oxide and oxygen anæsthesia. The bladder was irrigated through the suprapubic wound and the opening packed with gauze to prevent any leakage into the peritoneal cavity. An incision was made from a point just above the suprapubic incision in the skin to just above the umbilicus. The intestines were pushed aside, packed off, and the ureters exposed—the left ureter was quite distended with urine on account of the involvement of the left ureteral orifice by the growth; the ureters were dissected down toward the bladder and clamped about four centimeters from their vesical orifices. The ureters were then incised, the portion left attached to the bladder was well cauterized with carbolic acid and ligated. The operation chosen was Fowler's. The ureters were first sutured together in juxtaposition so the lower ends ran parallel with each other. A longitudinal incision of five centimeters was made into the rectal wall down to the mucosa—the muscularis and peritoneal coats were dissected and retracted. A U-shaped flap was then made through the submucosa into the gut, this flap was folded on itself and turned outward, being held in place by two sutures so as to have a mucous surface for the ureters to lie upon, to get thereby the valve effect of the everted intestinal wall on the ureters. An attempt was made to clip the ureteral ends obliquely that they might lie flush on the intestinal flap—this was found to be more theoretical than practical as the minute the ureter was obliquely cut the cut end became perfectly round. The ureters, stitched together as described, were placed on the folded piece of mucous mem-

brane and held in place by four sutures into the submucosa. The muscularis and peritoneum were then brought over and the rectal wound closed. The peritoneum of the abdomen incision was then closed and the attention directed to the bladder. It was with comparatively little difficulty that the peritoneum was stripped from the bladder and the rectum separated from the base. At this time the patient's condition grew desperate and the operation had to be finished very rapidly. I had intended to remove the prostate with the bladder as the growth, while not involving the prostate, was very near its posterior border. However, I did dissect the bladder down as near the prostate as possible. After removal of the bladder the vessels were tied and the cavity packed with sterile gauze, and the abdominal wound was closed allowing vents for drainage. Before closure of the abdominal wound gauze was packed down to the point of anastomosis of the ureters and rectum for drainage. This, however, was unnecessary as there was never any urinary leakage, the anastomosis holding perfectly.

The patient was severely shocked from the operation, although the loss of blood was very small. Under stimulation and salt solution he rallied and did fairly well for one week; it appeared as if he was going to recover from the operation. However, he complained bitterly of stinging in the anal region and great tenesmus whenever urine passed; there appeared to be no pain while the urine was collecting in the bowel. Sometimes he would retain his urine one and one-half hours. It was a continual fight to get this patient to take his nourishment. He seemed to give up after the operation, making no effort to help us in any way. There was no evidence of any abdominal infection and the one symptom he complained of was the pain and tenesmus during the passage of urine out of the rectum.

The patient had very little fever, but a rapid pulse and a leucocytosis of 26,000. There unquestionably was infection of both kidneys. He gradually grew weaker and died two

weeks after the operation. I endeavored to secure an autopsy, but on account of religious beliefs this was impossible. I feel that if I had insisted on the two-stage operation—double nephrostomy and removal of bladder at a subsequent operation the result might have been different.

The valve-like operation for anastomosis was very satisfactory and beautiful to perform, but I question if these valve-like operations for uretero-intestinal anastomosis would be permanent on account of the scar tissue following and obliterating the valves.

DISCUSSION

DR. HUGH CABOT, of Boston: I have totally extirpated the bladder three times, twice by the older method of attempting to do the whole operation at one sitting, and the third time by following as exactly as I could Watson's plan of a double nephrostomy, followed at an interval of about ten days by extirpation of the bladder. The difficulty does not seem to me to lie in the technique, because the operation done in that way is a perfectly practical and a not very serious one, but the difficulty lies in choosing the cases in such a way that we shall get them at a time when the operation can cure the patient, and not use it in cases that can be made comfortable for many years by some other procedure. The line must be drawn somewhere between the cases in which partial cystectomy can be done with good results, and those in which the involvement of the bladder and perivesical tissues is so extensive as to make any operation of no permanent value. My last case, the third case, lived a year, and might, I think, have been cured had I done the operation at the time when I first suggested it, but it made much the same impression upon him that it did upon Dr. Hagner's patient. He shied, and six months were wasted before he made up his mind that it must be done. It was a case in which a partial cystectomy had been done, with a good result for a year, and then there was a rather sudden and rapidly growing recurrence. At that time the growth had involved the prostate, and, though we removed the prostate with the bladder, we evidently did not succeed in extirpating the growth in that region, because it recurred in the perineum, ultimately perforating the perineum and the bowel practically at the same time. I was impressed by the fact that the operation

done in two stages is not in and of itself a very fatal procedure, and that if the cases can be properly selected it is perfectly conceivable, and, I think, probable, that radical cure might thus be obtained.

Dr. George S. Whiteside, of Portland, Oregon: I have operated on one case for total excision of the bladder for carcinoma. Not because I thought that I could cure the patient, but because of extraordinary pain; which was entirely relieved by the operation. Consequently I felt that the operation was justified. I did not do the operation in two stages, but all at one time, and pulled the ureters out through two incisions, one on each side, in the skin of the back. The operation is comparatively easy. I do not see much difficulty about the surgical procedure. My patient lived about six or seven weeks, and was up and around. He finally died of various other troubles.

Dr. Louis E. Schmidt, of Chicago: I do not think that we ought to let this subject go over like this. We ought to try to arrive at some definite conclusion as to the kind of cases that ought to be operated upon, as Dr. Cabot has stated. Now here we have two cases that have been operated upon, one a man of forty, and of course with possibly a long life ahead of him if the results had proved satisfactory. But at the present time the question arises whether this man's lease of life would not have been longer, first, if he had been let alone; secondly, if a palliative operation had been carried out; whether that would not have given him sufficient relief to have permitted him to live for some years to come. If I understand correctly the attitude of the large majority of Continental surgeons, they are under the impression that length of life, even in cases of this kind, according to statistics, is at least one or two years. Of course, during that period of time the patient may suffer more or less, but it is doubtful in my mind whether we can advise operative interference for the removal of the bladder at the present time where the mortality is still so high.

Dr. Edward L. Keyes, Jr., of New York: I have twice attempted total cystectomy in two stages, have gotten through the first stage and not had the patients come to the second one, and yet I still believe in total cystectomy. I do not agree that we are often justified in resting satisfied with a palliative operation, because so often the palliative operation does not materially palliate. Take a specimen like this of Dr. Hagner's, with an infiltration of considerable size in the wall of the bladder. It has been my experience that suprapubic drainage for patients

with that kind of tumor usually relieved their symptoms somewhat, but only somewhat, and that probably the prolongation of their life, with somewhat diminished sufferings for part of that time, was absolutely not worth while. On the other hand, I have, of course, seen cases, as all of us must have seen, where the palliation was considerable, where the patient actually gained weight after a purely tentative operation and lived for a year or eighteen months, and, in the third place, I have seen patients who apparently did very much worse after palliative operations, and apparently died quicker than they otherwise would have done. I do not know how to cut down the mortality of total cystectomy. I repeat, I have never yet got to a cystectomy. I am simply going to continue to try.

DR. L. E. SCHMIDT, of Chicago: I would only like to say this: I do not want to object to this operation, but I do want to say that our indications up to the present time are not thoroughly established, and if we do make a nephrostomy or ureteral transplantation, the question is whether we should not stop at that point and leave the patient alone, provided the bladder is involved to such an extent as this bladder was. I am under the impression that the preliminary operation might possibly be sufficient in a limited number of cases. The question of removing the bladder, naturally, is simply one of surgical technique, but there are other conditions to consider in all cases of cancer, no matter in what organ. The length of life is comparatively short, and I am inclined to believe that the bladder in these cases might be let alone, that the patient might go along for a good many years, probably much longer than when a cystectomy is made.

DR. EUGENE FULLER, of New York: Although most instances where ureteral transplantation into the bowel has been attempted have been unsatisfactory, still a few have been successful. I saw one case of extrophy of the bladder about two years ago that Dr. Albee showed in New York, in which he had transplanted the boy's ureters into the bowel. That child was certainly very comfortable. He would hold about six or eight ounces of urine in the bowel, and then pass it at intervals of about three or four hours. It is a question whether in some of these cases of vesical cancer you should not leave the cancerous bladder and transplant the ureters. Then there is another queer point about cancer of the bladder. Once in a while such cases, even without touching the ureters, live a very long time. I have a case now where I resected a large piece

of the bladder and did not touch the ureters. It was over a year and a half ago, and the man is wonderfully comfortable still. I have not seen him for some little time, and just lately the suprapubic opening has broken down more or less, and some urine has come out through there.

A man was referred to me by Dr. McConnell, of San Francisco, who had been operated on I think about two years before and a cancer of the bladder removed. When I saw him he had the appearance of a woman four months pregnant, so great was the big mass in the bladder, and he was still able to urinate and be fairly comfortable. He did not have uræmia and the ureters were not compressed. So that in some of these cases it is rather difficult to say when they are going to develop uræmia.

Dr. Hugh Cabot, of Boston: I am not at all in accord with the views of Dr. Schmidt. In the first place, it seems to me that the sidetracking of the urine is the whole show. If you get away with that, you have almost nothing left to do. The total removal of the bladder is not difficult. It can be readily done, and according to my view, can be done under spinal anæsthesia. To leave the cancerous bladder, having sidetracked the urine, seems to me a fundamental misconception of the nature of cancer of the bladder. We know that it is one of the latest forms to develop metastases. We know that from its extremely awkward position it would be one of the hardest to deal with. Now, if we can get the urinary trouble off our hands, the cancer problem in the bladder is far simpler than many other types of cancer with which we deal, and I should be greatly opposed to the doctrine that the sidetracking of the urine was the important part of the cure of the disease. After you have gone far enough to sidetrack the urine, it is the simplest thing in the world to go ahead and finish the job.

Dr. A. C. Wood, of Philadelphia: If a carcinoma of the bladder is discovered in an early stage, radical operation may properly, I think, be urged, as would be the case if any other accessible region were involved, and with excellent prospects of a permanent cure, as has been stated by Dr. Keyes and Dr. Cabot. Unfortunately, in the majority of these cases, the disease has reached an advanced stage when the patient first comes under the observation of the surgeon. In many of these a complete removal of the neoplasm is impossible without subjecting the patient to an undue risk at the time of operation or to the probability of troublesome sequelæ. For these, palliative measures only require consideration. Dr. Keyes has called our attention to that class of cases in

which a simple cystostomy fails to give the patient definite relief. In these instances it occurs to me that in addition, a bilateral nephrostomy, according to the method of Watson, might in a large measure ameliorate the patient's suffering. This suggestion is based upon the common observation that gastrostomy for complete malignant obstruction of the œsophagus, and colostomy for the same condition in the large intestine, results not only in giving the patient a great deal of comfort, but in the temporary restoration of the function of the affected viscus. That is, by putting the part at absolute rest the symptoms due to the disease become much less urgent.

Dr. C. L. Gibson, of New York: I had a case under my care a short time ago at the City Hospital where someone had previously performed a double nephrostomy according to the method of Dr. Watson. In that particular case I was very much impressed with the relief it afforded the patient. The principal discomfort that the patient complained of on entering the hospital was that there was a leakage around the tubes in the pelves of the kidney. A change in the size of the tube and getting tubes that would properly fit seemed to remedy that discomfort entirely. In that one particular case the individual seemed to be much more comfortable than if a permanent suprapubic opening had been made.

Dr. Francis R. Hagner, of Washington: I want to thank the gentlemen for discussing this paper. I did not expect that there would be as much discussion as there has been. Although the doctor cited two cases here that lived some time, I believe that if you put the ureter either in the rectum or in the skin you are liable to get pyelitis, and death in a short time. Most of these cases live less than one year. It seems to me that the most rational way to treat these cases is by double nephrostomy. It gives them a better chance, because you have good drainage from the kidney pelvis.

I agree with what Dr. Cabot has said. If this man had not been in such a bad condition from the operation, and I could have taken his prostate out along with the bladder, I think certainly every bit of the microscopical growth would have been removed. I do not know whether he had any glands up in his belly. He had none down along the iliac vessels. We do know that in these cases metastasis is slow, and we may yet be able to cure some of these cases by this operation. I now feel certain that I should not have operated on this patient, because he died; but if he had gotten well I would have thought that I was fortunate in hav-

ing operated. He would have lived longer with a palliative operation. There is no question that lots of these patients are very comfortable after palliative measures. I have used Dr. Young's suprapubic drain and I have patients who have been wearing with comfort this tube for a year or a year and a half. We have a patient now with sarcoma of the bladder, where the side of the bladder containing the growth was removed. He soon had a recurrence. It has been now nearly three years, and the man is living. I had a competent pathologist examine the growth. It was a round-celled sarcoma. He looks well and is comfortable. He still has his drain in, and pieces of the tumor mass come away every few days.

Another case of sarcoma of the bladder, operated about the same time, died in less than six months.

If there ever was a favorable case for operation, this was. The bladder was very badly involved, but no involvement of the prostate, vesicles or rectum. The rectum was freely movable, and that is shown by the ease with which the growth was removed.

THE AUTHOR'S OPERATIVE PROCEDURE IN CANCER OF THE PROSTATE

By Eugene Fuller, M. D., of New York City

IN operating for cancer of the prostate, it is customary for the surgeon to proceed just as he would were he dealing with senile hypertrophy. A prominent feature of the operations dealing with the latter condition, and one on which great reliance is placed, is that of enucleation. A skilled operator, after a senile hypertrophied prostate is once exposed through dissection, has no further use for the knife in effecting removal. He accomplishes his purpose through enucleation, the offending mass thereby being removed often in one piece, and very rarely in more than two or three pieces. A smooth, fibrous sheath encapsulates for the most part these pieces. In a minority of cancerous cases, representative of instances wherein malignancy has engrafted itself as a secondary process onto a previously existing senile hypertrophy,

the surgeon in operating can successfully employ enucleation, provided the growth has not already extended itself as an infiltrating process beyond the confines of the encapsulated prostate. In a large majority of cases, however, cancer attacks the prostate as a primary pathological process, and by the time such a case is placed on the operating table, the disease has involved not only the prostate but surrounding or adjacent structures as well. It is very unusual for the trigone and vesical neck to have escaped involvement in these conditions. Consequently it is beyond the expectation of the operator in most instances to be able to accomplish such a radical removal of the growth that there will be no recurrence. His real purpose rather would be so thoroughly to remove the cancerous prostatic obstruction that there would be not only a free voidance of urine after the operation, but also that such voidance should remain thereafter as long perhaps as the patient might survive, death resulting from an extension of the growth into another vital direction. In cases of this description the scirrhous element is commonly present in a greater or lesser degree in connection with the neoplasm. When an operator, after exposing the prostate, either suprapubically or perineally as the case may be, tries to effect removal through enucleation in such a condition he will be unable to find any line of cleavage. Through the exertion of much force he may be able to tear away irregular and ill-defined masses. In most cases, however, detachment cannot be accomplished in this manner without the aid also of cutting forceps and scissors. The result of such a procedure is the establishment through the growth of a urinary outlet, the walls of which are necessarily ragged and irregular. Some time ago, operating in this manner by way of a suprapubic incision, I encountered a cancerous prostatic growth of considerable size, the removal of which was essential. I found the operation difficult as the tissue, besides being scirrhous, was brittle and unyielding. With the use of scissors and forceps I separated the mass as much as possible, thereby

reducing to a minimum the work of forcible removal through the digital manipulation commonly used in connection with enucleation. In this case I was appreciative of the danger while using digital force of tearing the rectum, and consequently directed my efforts to guard against such an accident. All of a sudden the brittle tissue gave away laterally and the mass was free. With the removal there was severe hæmorrhage. I found that the sudden giving away laterally had been occasioned by a tear through the brittle tissue, and that this tear had radiated unduly beyond the line of separation, the result being that a large pelvic vessel had been opened. The hæmorrhage in this instance was fatal, as it could not be effectually controlled. Although I had long felt that the employment of forcible separation or traction in accomplishing removal in these cases had elements of danger which did not exist when the same forces were carefully applied in effecting enucleation of hypertrophies in benign cases where the surrounding tissues were natural and elastic, still this experience was sufficient to cause me to abandon the usually prescribed technique and to inaugurate the method to be now described. The object of this method is to place a minimum reliance on forcible separation and traction, at the same time correspondingly augmenting the employment of cutting devices.

The operation is as follows: First of all the area of the prostatic obstruction is exposed to inspection and manipulation in the greatest degree possible through the simultaneous employment of both a suprapubic and a perineal opening. This accomplished, what I will describe as a boat-shaped section of the growth is removed. The initial step in effecting this removal is the introduction through the perineal opening of a long-bladed, straight, blunt-pointed bistoury. The end of this instrument enters the bladder by way of the prostatic urethra. The knife thus lies above the middle portion of the obstruction. Through the suprapubic opening the knife can be observed and consequently accurately placed so that its end is brought beyond the intra-vesical limit of the growth,

and made to assume a correct position in the middle line with its blade turned downward. The patient being now in the lithotomy position, the operator with his right hand grasps the handle of the knife protruding from the perineal opening, while his left forefinger is introduced into the rectum, its ball being turned upward and made to touch the bowel wall in the middle line under the prostate. The operator then cuts through the prostatic mass down to or nearly to the bowel wall, the left finger tip warning him as to how far he should go. This cut represents, as it were, the keel to the boat. At the bottom of this cut the knife, without being withdrawn, is rotated so that its blade assumes a position to the right and at right angles with its former downward position. The left hand is then introduced suprapubically into the bladder, and the tip of its forefinger brought in contact with the blunt-pointed end of the knife, the right hand still holding the handle. Under such guidance a right elliptical incision is made, so that when the incision is finished the knife blade is left facing upward. The knife is next replaced into the bottom of the first cut, which represents the keel of the boat, and a left-sided elliptical incision made exactly similar to that on the right. These two lateral incisions represent the body or belly of the boat. The two lateral pieces are now adherent along the line of, as it were, the gunwale. In the final detachment, scissors are first introduced through the suprapubic opening and cuts made on either side along the gunwale line as far as can be. Then, the patient being again put in the lithotomy position, the scissors are introduced into the perineal opening and made to cut on either side along the external lines of the gunwale. With the meeting of the ends of these lateral scissor incisions the two pieces which go to make up the boat shaped mass are thoroughly detached, and can be extracted by forceps through the suprapubic opening. While using the scissors, especially suprapubically, moderate traction on a lateral piece through forceps is required, but the force so exerted falls far short of that required in effecting a

separation without cutting instruments, and is never sufficient to tear tissues.

It can, of course, be argued against this method that there is little in the way of radical removal accomplished through its employment. In answer to such an argument I would state that although the method does not attempt to be so radical as some others, still it is in its results as radical as any, besides having apparently a greater element of safety through an avoidance of certain dangers. Sometimes an operative method introduced in order to avoid dangers will be found objectionable on account of the new dangers which it introduces; but that objection cannot be raised against this procedure. There might, of course, be danger of severe or fatal hæmorrhage while making the lateral elliptical cuts. To avoid this I would recommend keeping within the general confines of the cancerous growth, and not trying to make a cut wide enough to get into unaffected tissue beyond. In fact, the operation is not advised for cases where a growth is so circumscribed as to be confined largely to the prostatic limits, but for cases in which the surrounding structures have become to a considerable degree secondarily involved. In cutting through cancerous tissues, especially of scirrhous consistency, little hæmorrhage is commonly encountered, provided, of course, the track of large vessels is avoided. This operation is accompanied by less degree of shock than is one associated with greater manipulative effort in connection with the removal of growth. As the seat of cancerous removal has a clean-cut margin, without tissue laceration, there is less danger of post-operative sepsis and of vesical incontinence. In fact some cases have had no such incontinence, and in most of them it has not been a marked feature.

A case leaves the operating table after this procedure with both a suprapubic and a perineal vesical drainage tube. About the perineal tube is a gauze packing which fills up the space left by the growth removed. An end of the packing protrudes from the perineum to facilitate its extraction. The

packing and the perineal tube are usually removed on the fourth day. The suprapubic opening is closed, with the exception of the space left for the drainage tube. This last tube is removed on the seventh or eighth day.

I have made use of this operation in eight cases, and have had no operative mortality in connection with it. The length of life following removal of cancerous prostatic obstruction wherein no expectation is entertained that all of the growth has been eliminated varies from a few months to one year as a rule, with exceptions wherein the period extends beyond a year and perhaps up to two years. This period depends upon the quality and rapidity in development of a growth. Were this short extension of life the only argument to be advanced in its favor, it is probable that few would submit to operation. It is the great pain and distress due to the resulting vesical retention which cannot be relieved by catheterization that drives a patient to seek relief from operation. Although it is possible that there may be a recurrence of retention later on, owing to reformation or extension of a growth, still such a happening is not frequent, and, should it occur, the track of the suprapubic cystotomy can be opened and maintained as a vent. The usual history of these cases after the removal of prostatic obstruction is a period of comfort until such time as the cancer through its extension causes disturbance elsewhere. If the bowel be thus invaded, or the liver, there will of course be developed symptoms such as accompany the disease when so situated. A not uncommon direction of extension is along the bladder floor. When this takes place it is usual for the ureteral orifices to be involved and eventually occluded. Such a happening will cause first hydronephrosis, and if this be not relieved, then death. Death from acute uræmia due to unrelieved hydronephrosis of this description is not painful. The uræmic poisoning generally causes a blissful torpidity, and, if it occasions delirium, the mental disturbance is often of a happy trend, or at least not indicative of suffering. It is, of course, perfectly possible to avert this

last complication and to still further successfully thwart the disease through the performance of double nephrostomy, thus giving urine a vent at the loins. This second operation has not, however, the powerful argument in its favor that the first one had—namely, the relief of great bodily pain and distress; the only point in its favor being a further prolongation of life, and that for probably but a brief period. I have met this last issue through the performance of double nephrostomy on five occasions; I prolonged life in one case three months, and in another two months; two desperately uræmic patients died promptly after operation, and one lived two weeks. From an operative standpoint the one who lived three months was a great success, but from other points of view there was nothing gained. What I did was to bring an individual who had passed into a blissful uræmic state back to a full realization of his bodily condition and suffering. This man never thanked me for what I last did for him, and his death was after the short interval less placid than it would have been had the uræmia been allowed to progress.

It seems to me that the only real argument in favor of nephrostomy in this connection would apply to a special case where there was some very strong or valid reason, such as the making of a will, for the brief mental and bodily respite offered. In all other cases I feel that I should not urge this final procedure.

DISCUSSION

Dr. Hugh H. Young, of Baltimore: I am very much interested in this paper of Dr. Fuller's, because I think we have had a tendency in the past to consider the subjects of inoperable cancer of the prostate and vesicles as beyond relief, and that the only thing we could do was to give them a catheter, supply suprapubic drainage or do a Bottini operation. The Bottini operation has been in a number of cases quite satisfactory, but not as universally satisfactory as we at first hoped.

I would like to mention the results I have had in over fifty cases of carcinoma of the prostate in which I have tried to do a very complete

removal of the lateral and median portions of the prostate, a somewhat modified prostatectomy according to the way in which I have usually done it. I want to lay stress upon the great ease with which you can shell out very completely the two lateral cavities, leaving only the capsule, although carcinoma is present and although the whole thing is fibrous and supposedly not enucleable; at the same time, it is perfectly easy to remove each lateral mass, often easier than in hypertrophy, because they do not usually project into the bladder through the vesical sphincter. When you come to the median portion of the prostate, however, the problem is mechanically a little different, in that it is not possible to turn your tractor and cause the median lobe to project into one cavity or the other, owing to the fact that the whole thing does not usually project into the bladder, but is simply an indurated mass below the urethra and above the ejaculatory ducts. But it is easier to use an instrument with a fenestra on one side and a punch on the other to push that mass by grasping it into one cavity or the other and remove it by means of a scalpel, or more easy is it to fork it up by a sharp tenaculum and cut it out in one piece. It comes out in a mass, as a rule, about as big as your finger. That leaves you with a cavity connecting with your two lateral cavities. There is almost always in these cases a sclerosis of the sphincter, and if you simply do what I have mentioned so far, you do not get good results. In recent cases I have stuck my finger in and widely dilated that sphincter. Since doing that I have had some remarkable results. There was one man who lived three years and eight months without any obstruction and died of internal metastases. Last year when I collected carefully the results there were then forty-two cases. There were 65% of really first class results, practically as good as you would get in benign operations. The average time that the patient lived was about a year and ten months. About four cases lived over four years; three lived three years and six months; and one case two years and eight months. I would like for some of you to try it in these cases where catheter life has been painful and in which you do not want to do a suprapubic drainage if you can help it. I am very glad Dr. Fuller brought this up. I personally believe you can get along without the suprapubic opening to help you. It is very easy to draw the prostate down and see what you are doing. There are a few cases, though, in which the process in the median part of the prostate has also elevated the trigone. With the cystoscope in these cases you see a markedly elevated trigone. I have

thought it advisable in five or six cases, after removing the median portion, to follow the finger and curet the trigone. In two of these cases I tore into the bladder in so doing.

DR. J. BENTLEY SQUIER, of New York: I might say in this connection that these more conservative operations which Dr. Fuller has detailed, frequently give particularly surprising results. Three years ago in June I operated for enlargement of the prostate, doing a suprapubic enucleation. Carcinoma was suspected. Section of the prostate proved such to be the case. The patient was then 82 years of age. The wound healed perfectly, and for a period of eighteen months he was absolutely free from pain and could empty his bladder. At the end of that time an increasing difficulty in passing urine became manifest and eventually he had to return to catheter life. He had very little pain, however. In December it was necessary to use the catheter nearly all the time and profuse hæmaturia was present. I again opened up the bladder suprapubically, and reamed out the recurrence of the carcinoma around the internal meatus. He did very well from that operation and was able to void urine again. He has had two operations for carcinoma, and both times the bladder has been allowed to heal. These operations have made life at least comfortable for him.

Another patient with a similar condition has had eighteen months of comfort following incomplete removal. In this instance I carried out the procedure that Dr. Young has spoken of.

I am firm in the belief that even incomplete removal of prostate or bladder carcinomata is justifiable if only to relieve the distressing condition of obstruction to urination.

DR. FRANCIS R. HAGNER, of Washington: It seems to me that in carcinoma of the prostate, from the limited experience that I have had, that there are two varieties. Some of these cases do very much worse if you touch them. I have seen some cases that have been operated on that were better for a month or six weeks, and then the tumor seemed to grow two or three times as fast as if nothing had been done. I had one man with a large carcinoma of the prostate where a portion of the prostate was removed so that the urine could pass. It has been now nearly three and a half years. He is a carpenter, and until about eight months ago was working every day at his trade. He now has a growth that absolutely fills his pelvis. He will soon probably have to have a colostomy done to allow the fæces to pass.

It seems to me from what Dr. Young says that we might try some operative procedure in some of these cases with good results. I have a patient now that was operated on four months ago by another surgeon, who did a prostatectomy, and there is now an enormous carcinoma where the prostate was.

Dr. Charles H. Chetwood, of New York: It seems to me in discussing this subject, aside from the technique, that it would be advisable if we could ascertain what conservatism and palliative measures have produced as compared with operation. I fancy that our friends, the internists, who stand between us and some of these patients, could tell us of many patients with cancer of the prostate who have lived on for a great many years. From my own experience, I have been impressed by the number of cases followed of cancer of the prostate that have seemed to live with a fair amount of comfort, unconscious of the nature of their trouble. Of course, I do not refer to those cases in which something has to be done for an impassable urethra, but to cases that can be palliated and where the cancerous growth seems to progress very slowly.

It would be very interesting to go over the field and find out what conservatism has shown in these cases and whether the conservative method has not even greater victories than some of the operative procedures. I have in mind a number of cases who are still alive who have never been touched by the knife. One man, happily a Christian Scientist, had revealed clinically a cancer of the prostate. He was under observation four years. One morning he came into the office after having taken an oil enema, which he urinated through his urethra. Still he lived and Christian Science helped him ignore his trouble. I have a number of other cases over 70 years old, who are able to use the catheter to relieve the bladder, and I think in many such cases it would be a pity to break in upon fairly peaceful existences by operative procedures.

Dr. Paul Thorndike, of Boston: I would like to ask Dr. Fuller if, in these cases of his where there was a cancerous condition left behind, whether he had any difficulty in healing a draining sinus?

Dr. Hugh H. Young, of Baltimore: In regard to what Dr. Chetwood has said, I did that very thing that he suggested in the Johns Hopkins Reports for 1906. I collected sixty-four cases there, which were all that we had had at the hospital at that time, and they were arranged in various groups, those treated clinically without a catheter, those with a catheter, those in which a Bottini was done, those in which a suprapubic

cystotomy was done, those in which a suprapubic prostatectomy was done, those in which perineal prostatectomy was done, and finally those in which a radical cure was attempted. Those statistics seemed to show that there was a certain percentage of cases that could get along perfectly well without a catheter, and also a small percentage that could get along perfectly well with a catheter, but the percentage of cases treated clinically without operation was very much smaller than those treated with operation; in other words, a good proportion of them actually came to operation. I personally always have a patient either do nothing or use a catheter at first. If, however, life becomes miserable and he has discomfort and all that, I think then you ought to give him a chance of relief.

In 50% of the cases carcinoma and hypertrophy occurred side by side. I had a case last year in which I did a perineal prostatectomy and removed a carcinoma. The patient had a good result for about a year, and then he began to have obstruction. He returned and had two large intravesically projecting lateral lobes which we found to be benign. So his failure to get a good result was due to hypertrophy of the lateral lobes. I think the fact that carcinoma of the posterior part and hypertrophy of the lateral lobes occur in 50% of the cases will modify in a way our surgical treatment of these cases and our realization of what has to be done.

DR. H. A. FOWLER, of Washington: I think we are to be guided in our treatment of these cases of carcinoma of the prostate by the end results obtained with and without treatment. Cancer of the prostate presents itself clinically in two forms. In one group of cases the carcinoma develops within a hypertrophied prostate and is not recognized by clinical methods. It is only recognized by microscopic examination of the excised gland. In another group the gland is definitely malignant, as evidenced by rectal examination, and the induration extends high up on the base of the bladder and laterally to the pelvic walls. All of these patients in the second group are suffering from two cardinal symptoms. One is retention, and the other is pain. The question that presents itself is whether we can offer these patients relief of the retention and the pain by operative measures. While my experience is limited to a small number of cases, I believe we are justified in operating to secure drainage and thereby relieve them of this most distressing symptom. In one of my patients the condition presented was that of simple hypertrophy.

The prostate appeared to be about the size of an orange, smooth, and without apparent involvement of the vesicles or the tissue between the seminal vesicles. Removal of the gland was followed by complete relief of the retention and the patient continued to empty his bladder naturally up to the time of his death two years later from metastases.

In another case a perineal enucleation was done for a small fibrotic prostate, which was considered malignant at the time of the operation. At the time he presented himself his complaint was incontinence. He was wetting his bed at night and his trousers by day. After he had passed 250 c. c., I catheterized him and withdrew 1750 c. c. residual urine. The operation was followed by complete relief of the incontinence and the bladder function was perfect for nine months. Then the tumor recurred and a catheter was used once a day to the time of his death, which occurred about eighteen months after the operation.

I believe that in these cases one is justified in operating if the patient is suffering from retention and catheterization is difficult, or if one can relieve the pain from which these patients suffer. I am not convinced that the operation hastens the growth of the tumor or tends to more rapid metastases in the majority of cases.

DR. FULLER: These eight cases which I operated on in the way described were cases where after exposing the prostate both suprapubically and perineally I could find nothing that I could enucleate. They were intensely hard and sclerosed. You could not find any portion that could be loosened or separated. They did not consequently represent cases such as Dr. Young describes—where you can get a line of cleavage. On cutting through the prostate capsule I found everything matted down and sclerosed. My point is that we should not try to enucleate in such conditions and should avoid disturbing the parts by using a great deal of traction and force in vainly attempting enucleation where it is impossible. My method of cutting in such cases avoids trauma and its consequent dangers, and is therefore more conservative and better.

But, of course, enucleation is the thing to do where it is possible. But in the cases I have described such a procedure is as impossible as it would be to enucleate a pudding stone that we see imbedded in a mass of natural mortar.

I do not think these cases are extremely common, but these eight and several I had before illustrate that condition. This seems a conservative operation to me. There is very little disturbance or shock in opening

both suprapubically and perineally in order to expose as fully as possible the diseased area for operation.

Dr. Chetwood spoke about conservatism in these cases; about how well some of them do if you do nothing. I think those are very valuable remarks, because there is nothing so unsatisfactory as to operate prematurely and not radically in cancer of the prostate. If one operates prematurely in these cases before the cancer has progressed far and while the patient is fairly comfortable, the operator is apt to get no credit, because as the disease progresses there is eventually a post-operative time reached when there is more suffering than was experienced before operation. I think it is very wise, if you want to act in a politic way with your patient, in a case where when first seen there was no chance of radical removal, to wait until symptoms have developed so that the patient suffers enough discomfort to make him obvious of the need of operation, and to prevent him from feeling that you are needlessly operating while he is comfortable or doing something which he thinks is inefficient.

Dr. Young's mention of the frequency with which you get carcinoma and hypertrophy together is a good point. You get a great many degenerative conditions of hypertrophy which develop into carcinoma. Everybody knows how often when you send what you think is a benign prostate to the pathologist he reports that it is malignant, and if you think it is malignant he may report that it is benign. It is very hard to get a good pathological report in these cases.

But those cases of mine simply represented instances of very hard, sclerosed cancer, which apparently started in the prostate, and which were primary conditions. They mostly occurred in people who were not so very old, and they were not subsequent to long continued trauma and discomfort, as in a cancerous process secondary to hypertrophied prostate.

I do not see that you ordinarily need to vary your technique in operating for cancer of the prostate from the methods used in dealing with ordinary hypertrophy, but the cases I have described represent a different condition which you could not manage successfully by the other methods which we have hitherto employed.

THE TEMPERATURE AFTER PERINEAL SECTION UNDER SPINAL ANÆSTHESIA

By Edward L. Keyes, Jr., M. D., and David W. MacKenzie, M. D., of New York City

OPERATIONS upon the male perineum offer a peculiarly appropriate field for experiments upon the newer methods of anæsthesia, for the circumstances under which such operations are undertaken often increase the risk of general anæsthesia by ether or chloroform to a marked degree.

Apart from prostatectomy, amid the dangers of which anæsthesia plays a familiar and important role, we may enumerate periurethral abscess and infiltration, tubercular fistula and stricture, and the graver types of gonorrhœal and traumatic strictures so often encountered among hospital patients, as conditions combining to a marked degree the perilous features of renal insufficiency, general debility, sepsis, and peremptory need of immediate operation, which features make them peculiarly unpromising cases for general anæsthesia.

Many ingenious methods of anæsthesia have been employed in the effort to minimize this risk. Among these the most important are nitrous oxide and oxygen, scopolamin and morphin, local anæsthesia, and spinal anæsthesia. Each of these has its advantages and limitations upon which we need not insist, for our experience has been chiefly with spinal anæsthesia.

The advantages of spinal anæsthesia may be summarized as follows:

I. It eliminates the danger of post-operative pulmonary complications.

II. It minimizes shock.

III. It spares the kidneys, at least to the extent of not

inducing oliguria during the operation, and by materially reducing the quantity of anæsthetic to be excreted thereafter.

On the other hand the following disadvantages may be alleged:

I. Failure of anæsthesia.

We have employed spinal anæsthesia at least 150 times and, excepting only one case whose spine we failed to enter, we have not once failed to obtain satisfactory anæsthesia of the perineum.

II. Shock.

A peculiar type of shock characterized by pallor, faintness, and slow or irregular pulse, is not uncommon during high anæsthesia and abdominal operations. This shock is readily overcome by the injection of two grains of caffein. It is moreover most uncommon during low anæsthesia for operations below the groin.

The question of post-operative shock we shall consider in detail further on.

III. Toxic complications.

We have encountered no unusual toxic complications, unless we include one case of sciatica, beginning four weeks after operation and continuing for several weeks thereafter.

Headache, chiefly by day, and when the patient is out of bed, is the bane of spinal anæsthesia. It is said to be due to marked increase or decrease in spinal pressure (in our cases it has seemingly been due to low pressure). It occasionally occurs after spinal puncture for diagnostic purposes, and is therefore perhaps due to leakage of the spinal fluid through the point of puncture after the needle has been withdrawn. This headache proved quite severe, and lasted on the average from ten days to two weeks, in about 25% of a series of all cases injected with stovaine solution and not included among those reported in this paper. Our present series injected with 5% tropacocaine have been singularly free from headache; less than 10% suffering more than a slight annoyance from this.

We believe that the intravenous or subcutaneous injection of 100 c. c. of salt solution is calculated to relieve the headache in the course of two or three days, but only four of our cases (in a series of over 100) have been sick enough to require this injection.

In spite of our good results we feel that the accidents occasionally resulting from spinal anæsthesia at the hands of competent men forbid us from urging its advantages too insistently. We shall continue to use the injection ourselves but do not feel warranted in assuming that it is free from graver complications than we have thus far observed.

Our technic is that of Prof. Bier of Berlin, communicated to us by Dr. Freeman Allen, anæsthetist to the Massachusetts General Hospital, at the suggestion of Dr. Hugh Cabot.

Let us now return to our special point: The advantage of spinal anæsthesia for perineal section, as suggested by its effect upon the temperature rise after that operation.

We have taken for comparison only those cases operated upon at Bellevue Hospital between June 1, 1911, and June 1, 1912, excluding all cases operated upon at other institutions and previous to this time, in order that the comparisons might be fair. Our list includes 52 cases, 26 operated upon under ether, and 26 under spinal anæsthesia.

The reasons for employing ether were mostly of an economic sort; e. g., because the patient requested general anæsthesia, because he was a foreigner to whom one could not well explain the situation, or because the apparatus for spinal anæsthesia was not at hand.

It so happens that the quality as well as the number of cases is about equally divided. Thus each anæsthetic was employed upon three patients with prostatic hypertrophy, seven with fistula and nine and eleven respectively with abscess of the prostate or perineum.

Our insistence upon spinal anæsthesia for all the worst cases is, however, perhaps best illustrated by a comparison of the patients' ages in the two series. Among those to whom

ether was administered the average age was thirty-three years, while but five of them were over fifty years of age, and but two over sixty. On the other hand the average age of our "spinals" was forty-five years; thirteen of them were over fifty and five over sixty.

All of our patients are alive to-day with the exception of two; one who died of shock the day after perineal section for ancient stricture and extravasation, and one who died two weeks after an attempt to close a tubercular fistula. Both had been operated upon under spinal anæsthesia, to which the death of the second case is directly, if paradoxically, attributable; for we should never have dreamed of attempting to operate upon him at all under any other form of anæsthesia.

In comparing statistically the cases operated upon under ether with these operated upon under spinal anæsthesia our first efforts were confined to the study of the pulse rate and blood pressure, especially at the moment of penetrating the deep urethra with the finger, while the patient was under the influence of spinal, as compared with general, anæsthesia. But the figures obtained were utterly contradictory and meaningless. We therefore proceeded in the present series of cases to study the rise of temperature after spinal anæsthesia as compared with the rise after general anæsthesia.

We have used as a basis of comparison the maximum temperature during the twenty-four hours before operation and have compared with this the rise or fall in the twelve hours immediately succeeding operation and twenty-four hours following this. Thus we have obtained two sets of figures: One showing the change in temperature for the day of operation; the other the change for the first day after operation. The only inaccuracy in our figures is introduced by eight cases who were operated in such emergency that we have not sufficient details of their temperature for the twenty-four hours preceding operation. The error introduced by these cases appears to us negligible.

As a result of our comparison we find that the rise of tem-

perature in the twenty-six cases operated upon under general anæsthesia averages 1.4° F., both in the twelve hours succeeding anæsthesia and in the twenty-four hours after that. After spinal anæsthesia, however, the average rise in temperature was 0.5° F. during the first twelve hours, and 0.8° F. on the day following operation. These figures may probably be interpreted to mean that the elimination of renal congestion accounts for the lower temperature throughout, while the marked difference between the half-degree rise following spinal anæsthesia, and the one and one-half degree immediately following general anæsthesia, is doubtless due not only to reduction of the renal congestion, but also to an actual blocking of the prostato-renal reflex by the local anæsthesia.

That this is so is suggested by a more intimate study of the figures. Thus, in the first 12 hours after operation under general anæsthesia, only three cases showed a reduction of temperature as compared with that of the day before, while eight " spinals " showed such a reduction. On the other hand, eighteen cases operated upon under general anæsthesia showed a rise of 1° or more in the first 12 hours as against nine " spinals "; ten showed a rise of 2° or more as against eight " spinals," and six a rise of 3° or more as compared with one " spinal."

In other words, the marked immediate rise of temperature so characteristic of perineal section done under general anæsthesia is absent when the perineal section is done under spinal anæsthesia. In our humble estimation this single fact renders spinal anæsthesia immeasurably superior to general anæsthesia for operations upon the male perineum.

TABLE I

Showing the rise, or fall, of temperature in degrees Fahrenheit, (A) in the first twelve hours after operation, and (B) on the following day, as compared with the maximum temperature during the day preceding operation.

	A		B	
	Spinal	Ether	Spinal	Ether
+4°	1	2	3	2
+3°	0	4	0	3
+2°	3	4	3	4
+1°	5	8	5	8
	5	3	7	3
	7	2	3	3
−1°	2	0	2	1
−2°	0	0	0	0
−3°	0	1	1	1

DISCUSSION

Dr. Hugh Cabot, of Boston: We have been using this method of anæsthesia now for nearly three years, and, with certain limitations, have come to regard it as the anæsthetic of election for operations below the umbilicus. My particular concern is, of course, with the genital and urinary organs of that region, but other members of the hospital staff have employed it in other departments.

It seems to me clear that one point alluded to by Dr. Keyes is of great importance; that is, the blocking of the impulses, thereby eliminating shock, and it seems to me that this is directly in line with the extraordinary work of Crile. He blocks locally, so to speak; this method blocks generally. It seems to me quite conceivable that it might be valuable in connection with general anæsthesia as well where the operations were higher than was entirely covered by the lower type of anæsthesia. It has not seemed to me safe, and I do not believe it will become regarded as safe, to use spinal anæsthesia for operations above the umbilicus. The element of danger is clearly increased.

In regard to post-operative pulmonary complications, I think it ought to be admitted that they are not entirely eliminated by this method any more than by local anæsthesia. That was gone into some years ago in regard to local anæsthetics, and it is perfectly clear that pulmonary complications following operation do occur in a good proportion of these cases. We have seen post-operative pneumonia, indistinguishable from that which follows general anæsthesia. It seems to me that in neither of these cases is the anæsthetic responsible, for I believe that most of these

processes above the diaphragm are of embolic origin and are very indirectly due to the anæsthetic. The proportion of the lung complications which are directly due to the anæsthetic is, I think, entirely eliminated by this method, but those which are of embolic origin would not be notably affected by any method of anæsthesia. They are post-operative and not post-anæsthetic.

The method has been taken up very slowly throughout the country, largely because of fears which seem to me groundless. If it be assumed that it is the anæsthetic of election for all cases below a certain anatomical point, I think we start at the wrong end. We should consider it from the point of view of its danger as compared with other anæsthetics in certain classes of cases; that is, an old man with an emphysema and a chronic bronchitis is a bad risk for any anæsthetic, perhaps less for gas and oxygen. Assume whatever risk you like for a spinal anæsthetic, and spinal anæsthesia still remains the anæsthetic of election. When you apply it to hernia, where the anæsthetic risks are nothing, you take it into a field where it does not belong. Why should we use it where there is no risk from any other anæsthetic? But in many of these perineal conditions where the subjects are poor, it has the advantage over other forms of anæsthesia from the start, and I am surprised that it has not become more generally used.

The technique is not difficult. We now insist that the house surgeons learn the technique, and they carry it out. For a considerable time it was done exclusively by Dr. Allen. Our residents recently have acquired the technique, so that we can have it whenever required in the absence of our anæsthetist.

Dr. A. L. Chute, of Boston: I have had a certain number of perineal operations by this method. It seems to me it is of tremendous advantage in these elderly people with bad kidneys. I have had two or three cases which an internist friend of mine said would not live, but which have gotten along perfectly well. Instead of having headaches, all of my patients have complained of feeling as if they had been hit in the neck, sometimes for a week and sometimes longer. Why, I do not know.

I think there is one little objection to mention, and that is that Dr. Allen is not willing to put these patients in the lithotomy position for the first twenty minutes after the anæsthetic is given. You cannot go ahead at full speed in the same way that you could if you could put the man up higher.

DR. H. M. CHRISTIAN, of Philadelphia: I was very much interested in this paper of Dr. Keyes. I have been using spinal anæsthesia at the Philadelphia Hospital, where we have the broken down derelicts of the city—old strictures, prostatics, extravasation of urine, etc.—and I have used spinal anæsthesia I suppose forty or fifty times in the past two years in my winter service, and I have never had any trouble with it at all. It has always been very satisfactory.

I must say that I never took the pains to carry out Dr. Keyes' observation as to the temperature. The one thing that I did notice following spinal anæsthesia was a headache in a great many of the cases.

I think it is a perfectly satisfactory procedure in perineal operations. I did last winter a total extirpation of the penis for cancer under spinal anæsthesia, and removed the glands in the groin, too, and there was no shock, and the man made an operative recovery, but, of course, died of recurrence later on.

I am very glad to learn the point that Dr. Keyes brings up of the condition of the post-operative temperature after the use of spinal anæsthesia.

DR. FRANCIS R. HAGNER, of Washington: Personally, I have used nitrous oxide and oxygen in these bad cases, with good results. I may be a little prejudiced aginst spinal anæsthesia. I have had no personal experience with it. The only two cases I saw it used on had very alarming symptoms. It was used by a gentleman, dead now, who was a pioneer in this work. He came to Washington and reported that he had done seventy-five prostatectomies without a death. He operated on two patients of mine. In one of the cases I never saw a patient so shocked as he was. His pupils were widely dilated, and we worked over him four or five hours after he was returned to the ward. Both of the cases he operated on only lived a week. I am very glad to hear these good reports.

DR. R. F. O'NEIL, of Boston: We also employ spinal anæsthesia for cystoscopy in selected cases, where local applications are insufficient, particularly in cases of renal tuberculosis with very irritable bladders, where it is necessary to catheterize the ureters. Also in other types of renal disease where an operation is contemplated and when the repeated administration of general anæsthetics is contraindicated.

Dr. Keyes spoke of the profuse sweating and shock which these patients occasionally exhibit. I have seen this several times. I recently performed an operation for varicocele on a boy of 16 or 17 under spinal

anæsthesia, he having developed a bronchitis the day scheduled for operation and being anxious not to have it postponed. About in the middle of the operation he became considerably "shocked," with profuse sweating and sighing respiration. It was only temporary and he was all right shortly after he got back to bed. I think in this case the mental attitude had something to do with it.

Dr. Hugh H. Young, of Baltimore: I was also led to use spinal anæsthesia by the same gentleman that Dr. Hagner speaks of, and I used the method in twelve cases of perineal prostatectomy and one kidney case. The kidney case was a man who weighed 350 pounds. I removed a quart of stones. I must say in that case it was wonderful. In the prostatectomies, in which we used cocaine, we had extreme shock, but none of them died. But they were the worst cases of shock I have ever had. Since then I have not tried it. It is very interesting to hear how successful it is. I did try it in some suprapubic cases, and apparently could not get the same anæsthesia there as in the perineum. I would like to ask Dr. Keyes what his results have been in suprapubic operations, either on bladder tumors or prostates? Certainly we are looking for something that is better than general anæsthesia.

Dr. Eugene Fuller, of New York: I have used spinal anæsthesia three or four times in prostatic work. The patients were absolutely comfortable and most of them conversed with me during the operation. In one of these prostatic cases there was a very curious hæmorrhage into the pelvis of the kidney later on. There was a good deal of post-operative headache. On account of reported spinal trouble or paralysis following its use, I stopped trying it. I do not personally know anything against it.

Dr. Keyes: I expressly avoided describing the technique of this operation, in the first place, because it does not bear description. I think there are so many little points that come up in doing that operation that we have got to see someone familiar with it do it several times before we get these points. Under such circumstances, any house officer can perfectly well do the operation. We teach our house officers how, although I personally get so much fun out of it that I like to do the operation myself.

The early procedures mentioned by Drs. Hagner and Young, which have brought disfavor upon the operation, are absolutely to be tabooed. There is no question that cocaine is toxic in the spine. It is my impression that tropacocaine is not only much safer, but more comfortable.

The patient's head must, within certain limitations, be kept up. You cannot put him in an exaggerated lithotomy position with safety. The shock that is felt by some patients is quite unexpected; you never can tell which patient is going to have it. It is rare when no attempt is made to get a high anæsthesia. I did a hernia before Dr. Squier, and the patient had a beautiful case of shock, but an injection of caffeine brought him out of it. It was annoying, but did not interfere with the proceedings.

As to the position of the pain, Dr. Chute is quite right; it is most often marked in the back of the neck.

Our operations, like those done by Dr. Christian, have been done in the City Hospital, where we get the worst patients.

As to our ability to get anæsthesia in suprapubic operations, we have not satisfactorily worked that matter out. I have done a number of suprapubic prostatectomies; I have done herniæ and ureteral implantation into the bowel, and in all of my operations it has worked well. It has occasionally shown only a partial anæsthesia, and if a patient is nervous he is likely to exaggerate his pain. The technique for obtaining satisfactory anæsthesia of the abdomen above the groin is not worked out to my satisfaction. Dr. Allen tells me he achieves this by injecting in the first lumbar or dorso-lumbar space, by diluting his one cubic centimeter of 1% tropacocaine to ten cubic centimeters and by placing the patient in the Trendelenburg position for one or two minutes.

THE LIMITATIONS OF THE CYSTOSCOPE

By George S. Whiteside, M. D.

UPON the subject assigned us for to-day I expect to learn much, but I doubt my ability to contribute anything that the other members of this Association do not know already. I see by the program that I am the only member who has fallen into the trap set for the unwary and written upon this assigned subject. Therefore, it is to be hoped that the discussion will prove the real exposition and not this paper, which is fragmentary and inadequate.

The limitations of the cystoscope are mechanical, anatomical and individual. The cystoscope of to-day is far more

useful than that of fifteen, or even of ten, years ago, but there is a limit which it would seem has been almost reached. In this, as in anything else, the man behind the gun is of first importance for results. Practice, dexterity, experience and good judgment are essential to the use of the very best instrument that ever will be invented. There have been many invented. Some of you have contributed. Fifteen years ago cystoscopes were mechanically imperfect. The lights were hot. I cauterized a bladder once with one of them. This was especially true of the German and Austrian instruments. The field of vision was small and dim as though in shadow. The mechanical contrivances for irrigation, catheterization, etc., were clumsy. These things have been remedied to a great extent in modern instruments. It is abundantly evident, however, that there is no one best cystoscope since there are so many on the market. This fact accounts for one of our present day difficulties in that there is no universally accepted best conducting cord attachment. If it becomes necessary to change from one instrument to another during an examination, unless the two are of the same make, the cords must be changed. This causes delay, especially in cases examined without anæsthesia. Some day we may have more uniformity and many patients will be thankful. Neither is there a standard size of catheter. Some instruments take No. 5 and some larger sizes. It would be better if we could agree on one size and stick to it. Of late years the larger sizes are most popular. It used to be thought the ureter would not admit them.

In the main there are but two kinds of cystoscopes—direct and indirect view. Of course I refer only to cystoscopy in a water medium. In regard to the air dilating cystoscopes the worst feature of them is the pain occasioned by the air pressure in the bladder. My patients have complained of this bitterly. In other respects air filling entirely overcomes the limitation imposed upon operating in a water medium by bleeding. I know no one who uses air dilating cystoscopes

nowadays excepting some who catheterize the female ureters through an open endoscope tube.

To return to water cystoscopes: With an indirect view instrument it is almost always possible to find the ureter openings but not always possible to enter them. With a direct view instrument they are sometimes impossible to find, though when found they may be readily entered. Even a retrograde attachment does not give a really good view of the neck and outlet or of some deep pocket in the bladder. It is entirely a matter of personal equation which general type is preferred. Some surgeons incline to one and some to the other. Necessarily the indirect view instrument is the best examining cystoscope. There is no question as to that. It seems to me that the effort now being made by most instrument makers to transform an inverted image to an erect one as a waste of time. What difference does it make to the skilled cystoscopist whether the image is inverted or erect? It is all a matter of habit. If the surgeon is accustomed to viewing inverted images he can judge of them just as accurately as another can of erect images.

In regard to facility of introduction of the instrument into the bladder: of course if the urethra is too small it must be suitably dilated. This having been arranged, undoubtedly the less the calibre of the cystoscope shaft consistent with a reasonable sized visual field, the better. This applies even more to all sorts of operating cystoscopes than to examining ones. It is now generally considered that the shaft should be round or only slightly oval. All channels for irrigation, catheters or other appliances should bulge interiorly, but not peripherally. Irrigation channels should be of generous size, otherwise they are of no use whatever. A small trickling stream will not clear a clouded filling fluid. Channels for ureter catheters (of which there are always two on all modern instruments) should never be continuously closed as in some used ten years ago. It should be possible to catheterize one ureter, free the catheter from the cystoscope, empty and refill

the bladder, reintroduce the cystoscope for examination or to catheterize the other side. This is not often a necessary manœuver, but bleeding or a burned out lamp sometimes make it imperative. I have had difficulty at times, when attempting this, with the beak of the instrument catching in a loop of the already placed ureter catheter and partially or wholly withdrawing it from the ureter. This has proved especially likely to happen with a catheter with a lead wire in it placed for X-ray diagnosis. The advantage of the ordinary lead wire threaded catheter is that one can collect urine from it in addition to having an X-ray plate of it. Otherwise I have thought a closed end bougie filled under pressure with metallic mercury would present some advantages over the wire in the catheter. Every ureter catheter should accurately fit the channel of the cystoscope. If too large, it cannot be easily pushed along and, if too small, water leaks out alongside it in spite of the little rubber nipples intended to prevent it. It saves disappointment to try squirting water through a catheter before attempting to use it. Sometimes it is stopped up. I think the flute ended catheters drain better than the side hole kind, but perhaps they are a little more apt to make the ureter bleed, which, though not always of consequence, introduces an uncertain source of error in the final estimation of the patient's condition because it may be a puzzling matter to decide whether the blood in the specimen obtained is due to disease or traumatism or to both. Generally I use a plain catheter on the supposedly sound side and one wtih centimeter rings marked on it on the suspected side. This I do because occasionally the side suspected produces the best urine and then one is inclined to think the catheter may have become twisted, if they look just alike.

After catheterization, with the catheters left in place, in a patient who has had a general anæsthetic, his arms should be outside the bed clothes and a nurse should watch him every minute, otherwise he may remove the catheters before enough urine has been collected for examination.

Our Secretary, Dr. Squier, will speak of electrical cauterization with the cystoscope to-morrow so I will not touch upon this point.

Many of you have had, so you say, satisfactory experiences with operating cystoscopes. Frankly, I have not. As soon as I begin to cut or snare something, blood obscures my vision. Perhaps it is my fault. Snaring off little bits of tumors or even biting them off with any device will always be open to the objection that if the tumor is malignant the base has not been removed. Of course the base can be cauterized. Stones may be crushed and washed out as well or better with the old fashioned lithotrite as by one attached to a cystoscope. I have never been able to crush a stone without causing bleeding. Maybe some surgeons can do it. Even with constant irrigation blood clouded filling fluid is not a good visual medium, nor will heavy pus be sufficiently washed away from the floor of the bladder. Even with general anæsthesia a contracted bladder will sometimes refuse to hold the minimum amount for an examination. At the American Urological meeting in Chicago some said they expected to see the day when almost all, if not all, calculi would be removed from the ureter by cystoscopic methods. I cannot agree with this. The surgical procedure is neither very difficult nor very dangerous and the cystoscopic method is uncertain in results, often causes much delay and inconvenience to the patient and at the end of it all open incision may become imperative. Dr. Bryan, of Richmond, Va., reported a series of cases of ureter stone, most of which were passed *per urethram* after injecting the renal pelvis with oil. I have never had much luck at it. A few pass the calculi but most of them come to open operation.

I believe filling the renal pelvis with an opaque solution for the diagnosis of pelvic dilatation or ureteral kinks is a valuable procedure. Some say it is not necessary and adds little to what can be determined without it, X-ray pictures of the kidney for instance. Some fill the kidney pelvis with an

antiseptic solution, after any instrumental disturbance of it, to prevent the possibility of accidental infection. It seems a reasonable precaution.

The determination of the functional capacity of either kidney is perhaps the greatest triumph of modern cystoscopy. It undoubtedly has saved more lives than any diagnostic measure in urinary surgery. This will have an even greater value in the future as tests are perfected and simplified. I include in this statement not only tests for permeability of water or solids but the older chemical methods of urinary examination as applied to the separated urines. All these things you gentlemen know as well or better than I do. It is a waste of time to dilate upon them.

In regard to inspection of diseased conditions in the bladder it is entirely a matter of personal experience and judgment. Even the best of us will, from time to time, see lesions he cannot correctly interpret. Permanent records by means of cystoscopic bladder photography is a fascinating amusement for the surgeon. The pictures are not of much value when, as at present, they are merely outline shadows. Color photography would be a great advantage but has not yet been sufficiently perfected.

In Oregon our cystoscopic difficulties are somewhat different from yours in New York or other Eastern centers. In the first place no truer word was ever written than when Casper, of Berlin, said that cystoscopy " must always remain the trick of a few." In our part of the country one might say of a very few. For instance, I went to Seattle the other day to see a case in consultation with Dr. Peterkin. It would seem ridiculous to any one of you in New York to send to Boston or Philadelphia for a surgeon just to have him look through a cystoscope with you and give his opinion. You could find a consultant in your own city. So you can see that the limitations of cystoscopy in our corner of the country begin with the fact that anyone of us there never can find another to look through his cystoscope who is wiser than himself. It teaches

self-reliance but the field of vision is necessarily limited to a narrow experience.

Our next great difficulty is with the repair man. There is no skilled workman nearer than Chicago who can repair an instrument. This means expense in owning many cystoscopes and delay oftentimes when very inconvenient.

Those of you who have invented or adapted cystoscopes know the mechanical difficulties better than the rest of us. Often I do not know why the field of vision becomes dim or an electrical short circuit occurs. It is quite annoying to have your last light burn out or some other accident happen during an examination. It is especially so when you are examining a patient in consultation with some old fashioned practitioner who thinks he will give you a chance to demonstrate your vaunted diagnostic superiority although secretly he believes more antiquated methods of examination are less open to error or misrepresentation.

We have made great advances in the last ten years, especially in estimation of renal disease, but the end is not yet even in sight. Urinary surgeons of 1922 will disrespectfully reflect upon our blunders. By then we will have really entered upon the era of replacement of a bad kidney by a good one. It seems as if the diseased man of the future might be almost as readily patched up and repaired as a worn garment. In this even cystoscopy will be considered even more essentially important than it is now.

DISCUSSION

DR. EDWARD MARTIN, of Philadelphia: A case was sent up from another service to my own, with a diagnosis, in the hands of an experienced man, of malignant disease of the bladder, involving the anterior wall. I opened the bladder, and all that was found was an ecchymosis like that which would follow the rough use of an instrument.

In a second case, one of our young men found a ureteral calculus too big to hope for passage. I cystoscoped again and found very little change in the ureteral orifice, but my catheter was stopped at the same measure-

ment. One of my assistants opened up the ureter and found it clean. I do not know yet how to avoid an error of that kind.

DR. LOUIS E. SCHMIDT, of Chicago: Only a few months ago a case was referred to me for examination. This patient had been abroad over a year ago, and had been examined by two of the best known cystoscopists in Europe. This woman was advised to be re-examined in order to establish whether a distinctly localized area, located in the bas fond, had changed in appearance. A description of this condition had been given to the doctor in charge at that time. She was a woman of about 42 years, who had had several extremely difficult labors some sixteen or eighteen years previously, high forceps in one case, and who had developed after that certain bladder symptoms. In the last ten years, however, she had great frequency and more or less pain. For this reason it was considered a bladder case. Nothing except this area, plus a general prolapse of her genital organs, could be noted. The diagnosis by the European cystoscopists was probable neoplasm. I examined this patient without using an anæsthetic without any difficulty, and I noted this area. From the description that accompanied the case I was under the impression that there was absolutely no change in appearance. Upon introducing the finger, however, into the vagina and palpating this area, and putting it on a distinct stretch, the peculiar appearance that was described and that was considered a neoplasm, disappeared, and simply a very congested area of mucous membrane remained. There was no infiltration whatsoever.

I wish to bring up this case in order to show this diagnostic aid in connection with cystoscopy. I have found it necessary to use this aid very often, and it has been of great help to me, particularly in cases of diseases of the female bladder, in helping to establish a diagnosis. I made a diagnosis in this case of injury to that bladder at the time of the difficult labors, and that this condition that was seen had nothing to do with the symptoms she has had all these years, but that the symptoms were entirely due to the prolapse. I could positively see nothing but a regular outline without any infiltration, only a changed appearance of the mucous membrane, the entire area not much larger than a five-cent piece.

A second case I would like to report, which I think I have mentioned before, in which there was an error in diagnosis: Two years ago or more I saw a patient, a woman about 32 years of age, married, who came to me asking for confirmation of a diagnosis. There had been a diagnosis

by one of our best cystoscopists in Chicago that her right kidney was involved, and that a nephrectomy was necessary. On examination, the left ureter was easily seen, the left side readily catheterized, but on the right side corresponding to the ureteral orifice there was an opening from which a thick, putty-like mass made its appearance. This putty-like mass appeared like a long worm, and rolled itself up in the bladder. This worm-like mass was perhaps from three to five inches long. On examining it further, by severe manual pressure I was able to express more and more of this mass. This mass was so thick that it did not mix readily with water, and remained coiled up on the bottom of the bladder. On examining further, the right ureteral orifice was discovered, perfectly clear urine seen to come from it, and I catheterized this size and collected sufficient urine for examination. The diagnosis was made of a ruptured tube into the bladder of long standing, which had existed for years. I asked Dr. Frankenthal to operate on this patient. The tube was removed and the condition positively demonstrated.

Dr. J. Bentley Squier, of New York: I do not mind joining this coterie of truthful persons, and as I arranged the program, I shall take the liberty to disarrange it. One of my specimens I shall show now and tell the story.

Sometime ago the resident surgeon of the Sailors' Long Harbor Hospital on Staten Island brought a patient to my clinic and asked me to cystoscope the patient, as the patient had a great deal of pain and inability to urinate. He was a man 70 years of age with prostatic obstruction. I cystoscoped the patient and found a phosphatic calculus behind the prostate. I advised the physician to take the patient back to the hospital and do a preliminary suprapubic drainage under local anæsthesia. I told him that a stone was there and showed him the stone. A few days later he 'phoned me, and said that he had opened the bladder and drained it, but had failed to discover the stone. I was very much nettled, because I was sure I had seen the stone. He was just as sure that he did not find one. A few days later the surgeon 'phoned me that the bladder was intensely foul, that it had not cleared up any under drainage. The following morning the man died, apparently from an extension of this inflammation into his kidneys. I requested him to do an autopsy at once and take out the whole bladder. I was quite sure the stone was there, and this is the bladder which he took out. (See Plates II and III.) We discovered that what had happened was this: Here was

PLATE II. — Presented by Dr. J. Bentley Squier

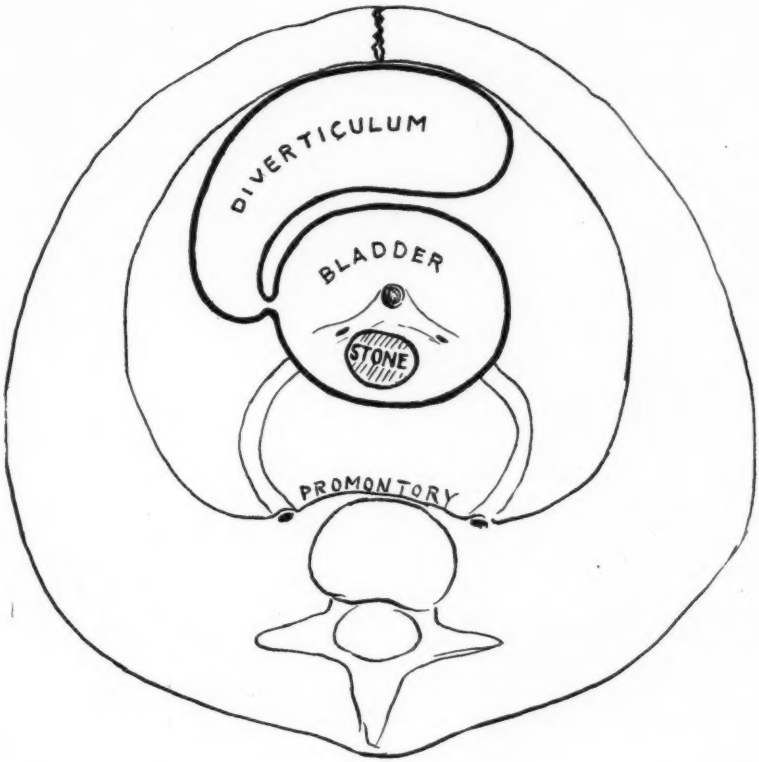
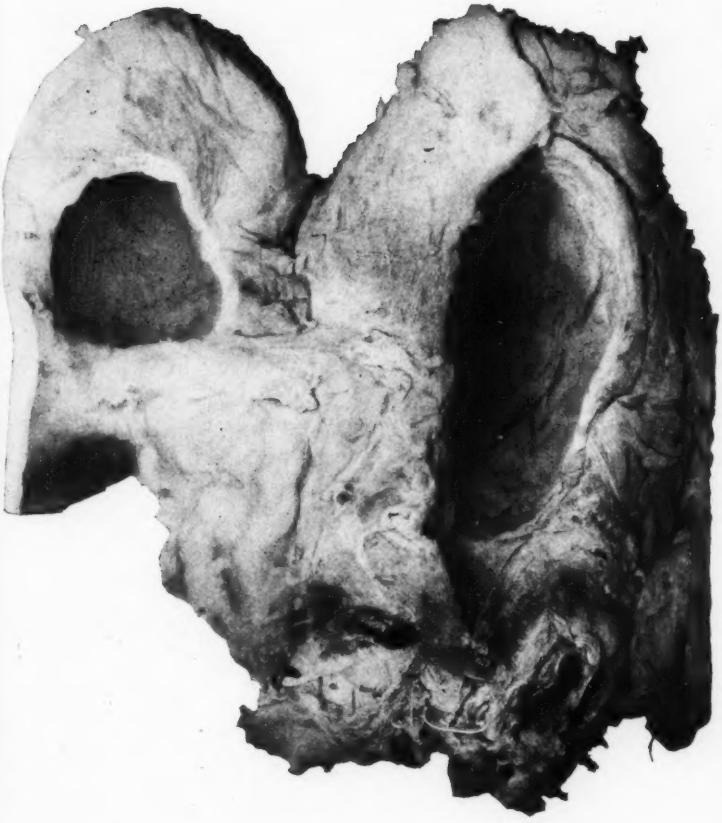


PLATE III. — Presented by Dr. J. Bentley Squier



the bladder into which the cystoscope went, and the stone was behind the prostate, but coming from the right side of the bladder was a very small opening which, seen from the cystoscope, looked just like the shadow of a very small diverticulum. This diverticulum came around on the top of the bladder, and what the surgeon had done was to open into a diverticulum of the bladder and had not drained the real bladder at all. It gave the man very little relief, because the opening between the bladder and the diverticulum was so small that scarcely any drainage could be gotten through it. It is interesting from the fact that at the time of the cystoscopy the diverticulum was not considered to be of more moment than possibly a little sacculation on the side. The diverticulum was capable of distention so as to come up over the front and cover the urinary bladder.

It should be a routine practice to try to measure the capacity of such diverticula by observing the length of ureteral catheter which can be forced into them. Their relation to the bladder can at times be well appreciated if radiographs are taken of the bladder after it has been distended with argyrol.

Dr. G. K. Swinburne, of New York: A point that is probably familiar to others of you that I only discovered recently is the difference between the olive-tipped catheters and the ordinary ureteral catheter. The first catheters that we used were all olive-tipped, and for a number of years I have not seen one; but this winter we had two cases in which it was absolutely impossible to get into the ureter on either side with an ordinary ureteral catheter; but getting the olivary catheter with the flexible tip, both ureters were entered without any trouble. In the future I shall use the olive-tipped catheter very much oftener than I do now.

Dr. Whiteside spoke of the ease of catheterizing with the direct cystoscope, but the difficulty of finding the ureteral orifice, but the reverse with the indirect. It seems to me that it is much more so with the newer instruments. I know I find a great deal of difficulty with my indirect cystoscope. It is very easy to find the ureteral orifice, but very difficult to get into it. I much prefer my direct cystoscope.

Dr. B. S. Barringer, of New York: I would like to say a word on one phase of this subject; that is, the use of the Luys separator in children. There are two objections to the cystoscope in children; namely, the small size of the urethra and the necessity for a general anæsthetic, both when the cystoscopy is being done and in many cases while the urine

is being collected. The small catheterizing cystoscope which we use in children takes only a No. 3 or 4 ureteral catheter, which is too small to collect urine at all well, and is easily clogged. I have only done three or four cases in children, a couple of them being boys of 6 or 7 years, and in those the child's Luys separator, 17 French instrument, has enabled me to collect enough urine to make a complete diagnosis of the kidney condition in from ten to twenty minutes. I think that is a valuable instrument in these cases.

DR. HUGH H. YOUNG, of Baltimore: I have had the usual line of failures mentioned here—practically all of them, I think. I remember one case that I was very much ashamed of. I thought I had seen by the cystoscope a large tumor clinging by a pedicle from the left half of the bladder. I went in, wiping the bladder as we went in, and found nothing at all. I found simply a partially organized blood clot. On further examination of the posterior wall of the bladder I found a small pinpoint opening which went into a diverticulum, and by inserting a clamp into this we found an extravesical diverticulum carcinoma, which bled slowly into the bladder.

I had another similar case in which I went in in the same way and found only a blood clot.

It seems to me the trend in cystoscope building in the last year or two, while it has reached perfection in a good many ways, has resulted in the production of instruments that are not as good as the old instruments. The old Nitze cystoscope had an angle of view of ninety degrees, and while the view was inverted, and while it was not particularly bright, and while the lamp was rather hot, the lamp would last a year or two, and if you were careful you would not get vesical burns, you saw a big field, and I think it was an extremely good instrument. Now, with the introduction of the Zeiss lens system you get a very much smaller angle of vision, and I think often a very much less helpful cystoscope. You cannot cover anything like the amount of space, and if you use it in an operating cystoscope, particularly with that intravesical rongeur which I have made, you cannot see the blades of the rongeur as widely separated as you ought to. It is almost impossible to get the instrument makers, here or abroad, to give you as good a straight operating instrument as the old ones. I think you really lose a good deal sometimes in trying to get a corrected image. With the complicated lens mechanism that is necessary to get that, you certainly lose in the size of the field of vision, and

for practical purposes the size of the field is an extremely important thing. I think also that some of the extremely fragile but very brilliant lamps produced recently are of questionable value as compared with the good old hot lamp that lasted forever and did not burn out, and with which you did not have to be so careful about jarring your instrument. It seems to me that in these new instruments the contact is bad. The place where the cord joins the fixed point of the contact is not good, and very often at the time you want to use it your contact is bad. Another thing is that the eye-piece is surrounded by a bell, and that is serrated so that you can rotate the instrument. Your hands are almost always dirty. The result is that, when you work close you are rubbing the instrument against your eyes and eyebrows. It seems to me it ought to be made like the old original Nitze model with the serrated edge at least an inch from your eyes. There are various little things like that that a body of men like this could formulate ideas upon, and give them out to the cystoscope makers, because they are dependent on us, and they do a lot of perfectly ridiculous things. It seems to me that the anterior view lens is bad. You try to catheterize the ureters with it and you are catheterizing from the corner of the field. You cannot elevate your catheter and still have it in the middle of view; when you raise your catheter to the proper angle it necessarily assumes the periphery of the field of vision and makes it infinitely more difficult to catheterize.

Dr. A. L. Chute, of Boston: There are two or three points that I would like to speak of.

One thing that I think is a distinct limitation in our cystoscopic work is the difficulty of judging the size of things. I think it is very, very difficult to judge of size. You may be farther away than you think. Take a ureter catheter of known size, put it beside the object and see how large that catheter is compared with the object. Then by making a proper deduction you can usually draw a conclusion as to how large it is.

A maneuver that I have used occasionally in order to prevent leakage around the ureteral catheter is this: To take an Albarran jointed whalebone and pass it into the ureter, remove the telescope, and then thread over this whalebone a ureteral catheter as large as 10 or 12 French. In this way you will prevent your extra catheter flow. I have never used it in men, and do not know whether it is possible or not.

Another limitation I have thought of—I think Dr. Young has mentioned it. I got caught on it the other day. This man had had pain. I

catheterized the right ureter, injected the pelvis, and got a large mass. I cut down on this side. I felt a small kidney, and I felt through and apparently there was a larger kidney. I supposed I had a bifid ureter. The patient's condition was too poor to allow me to go ahead, but in the light of Dr. Young's case it seems to me that I had a division of the pelvis with a very distinct separation of the kidneys.

About the X-rays with the leaded catheter: It seems to me there is one step beyond that; we have got not only to use the X-ray catheter, but we have got to go further to eliminate those little phleboliths; it seems to me we have got to come to the stereoscopic picture. When they do happen to be in the same line, the stereoscopic view, which gives you depth, gives you a beautiful demonstration of the condition.

I cannot agree with Dr. Barringer that the No. 4 or 5 catheter does not give you a pretty good amount of urine. It has with me, particularly if the urine is not very foul.

Dr. John H. Cunningham, Jr., of Boston: It seems to me that everybody who uses the cystoscope must occasionally encounter certain small limitations in individual cases which make the examination incomplete; but more important than this is what might be termed a general limitation that I think should be more clearly given to the profession. I refer to patients sent to us with the idea in mind that by simply looking into the bladder all questions are going to be settled then and there. That, I think, is not always possible at one examination, and patients and practitioners ignorant of this are sometimes much disappointed in consequence.

I can cite several such instances. One, a patient sent to me with a supposed tumor of the bladder. At the time I examined him there was a great deal of blood in the urine. I noticed through the cloudy medium a small white area that might have been a growth, but it was impossible to be certain. The patient, not being willing to have another examination, I made a snap diagnosis—and I believe it was a snap diagnosis, although there was some visual appearance leading one to believe that it might be a growth—and sent him to Dr. Binney for fulguration. Dr. Binney later informed me that he had made a satisfactory cystoscopic examination and there was no tumor in the man's bladder. At a later date the true condition was found to be bleeding from the prostate.

Another patient sent by a doctor for cystitis led me to believe that he had tuberculosis of the bladder, though he had no renal symptoms, and

the vesicles, prostate and genitals were negative. The patient could tolerate but two ounces in the bladder and the examination had to be made under ether. I was able to get the first ureter, but before I could get the other the ulcerated bladder bled so freely that no further examination could be made. I know nothing, therefore, about the condition of one kidney in that man, and it is necessary to go through this procedure again. I think we should attempt to correct the impression that a single cystoscopic examination always suffices to make a diagnosis.

DR. H. M. CHRISTIAN, of Philadelphia: I agree with Dr. Whiteside that in the use of the cystoscope it depends entirely upon the man in front of the cystoscope; it depends on his experience, his good eyes, and his practice, and without these the cystoscope has absolute limitations.

Another absolute limitation to the cystoscope is the contracted bladder of tuberculosis that Dr. Cunningham spoke of. There is, of course, the limitation with hæmorrhage. It is perfectly ridiculous to hear these cystoscope makers tell you about cases of hæmaturia in which the bladder medium could be washed clear in one minute. Very often I have found when I wanted a clear medium that I never could get it.

Another thing that I think ought to be impressed by us upon the general profession is that this is an instrument that requires constant practice in its use, and that the fact of a man going and taking twenty lessons in a Polyclinic school does not make him a cystoscopist. I find all sorts of ideas among some of the younger men. I hear of diagnoses made by them by the cystoscope that are clinically absolutely wrong.

DR. HAGNER: They were all teasing me some time ago about rubbing white lead on the lens to keep it from leaking. However, there is one point that is absolutely necessary, and that is for a man to clean his own instruments and not let nurses or somebody else do it if he wishes to have a cystoscope in good condition.

DR. WHITESIDE: There are just two observations that I would like to make. One is the attitude of the general medical profession, the general practitioners, to the genito-urinary surgeon in regard to the cystoscope. I think it is particularly to be noted in regard to the older men among the general profession. That is, they bring you cases, and unless you can do all kinds of things that are really impossible, they will be very dissatisfied with cystoscopy as a whole and your cystoscope in particular, and will never try it again, and they will thereafter go back to various unscientific methods of diagnosis of their urinary cases.

The other thing is in regard to the general surgeon's attitude toward cystoscopy. The general surgeon asks the genito-urinary surgeon to come in and cystoscope a case and tell him all about it and get it all planned out and laid out and fixed just as easy as can be, so that he can do the operation and get the fee. I do not think that is right.

SOME OBSERVATIONS UPON DIVERTICULUM OF THE BLADDER

By Hugh Cabot, M. D., of Boston

THE subject of diverticulum of the bladder has, on the whole, attracted less attention, until very recent times, than its importance would justify. Of course, little or nothing was known of these conditions until the routine use of the cystoscope led to their discovery before such time as they produced recognizable symptoms. There can be no doubt they are a factor of extreme importance because, though they may occasionally exist throughout life without producing important damage to the urinary apparatus, this is the result not at all to be expected and they are capable of producing an amount of damage which leads to the death of the individual.

Different Types of So-called Diverticula

Some confusion has arisen through failure to separate the different types of pouches or diverticula which are found in the urinary bladder. Thus the small hernial protrusions between the muscular fibres which occur in subjects with chronic urethral obstruction bear no relation to true diverticula. They are simply the result of weakness of the bladder wall when put under strain, are directly due to the obstruction and lose their importance when that obstruction is removed. The pouch connecting with the vertex of the bladder due to failure of closure of the urachus should also be distinguished from the type of diverticula of which I wish to speak here, since it is in and of itself a perfectly definite failure of devel-

opment, occupies a constant position and is comparatively unimportant in the surgery of the bladder. The word " diverticulum " should, I think, be confined to those cases of pouches, always of congenital origin, occurring most frequently in certain positions, but occasionally seen in almost any portion of the bladder, and not due to defective development or lack of closure of any recognized structure. I cannot agree with the view expressed by Chute in a recent paper that they originate in the little pouches normally seen just above the ureteral orifice, and that they become important only when this pouch is exaggerated as the result of obstructive pressure. My reason for disagreeing lies in the fact that they are so frequently found in individuals in whom obstruction is totally absent, in whom in fact the symptoms of obstruction are due not to any obstruction but to the diverticulum. I incline to the view that when found in individuals with urinary obstruction they are an accidental finding and of no etiological significance. That they are due to some embryonic defect is clear but I have as yet seen no adequate explanation of their formation beyond the fact that they are associated with peculiarities of the closure of the cloaca, perhaps with a tendency to budding from this structure. It is to be hoped that some of our embryological brethren will produce an adequate explanation.

Congenital Diverticula

These diverticula are covered by the normal coats of the bladder, though the contractility of their muscular fibres is at times certainly defective. The position of election seems to be in the immediate neighborhood of the ureteral openings and it is to this fact that they owe their greatest potentiality for harm. They are also seen on other portions of the base of the bladder, on the sides and even near the vertex but those occurring on the upper segment of the bladder can do less damage and are therefore less important.

Effect Upon the Urinary Apparatus

These effects are largely from two sources: First, those arising from pressure upon the ureter, and, second, those arising from the inability of the diverticulum to empty itself completely and therefore its great liability to infection. The importance of diverticula in the production of hydronephrosis has not, I think, been sufficiently emphasized. The frequency with which they occur in relation to the ureter and the tendency of the ureter orifices to lie in the diverticulum or to be drawn into it, at once puts the integrity of the kidney upon that side in jeopardy. The distention of the diverticulum will always put abnormal pressure upon the ureter and should that structure follow the lower border of the diverticulum (as is not infrequently the case) a valve-like arrangement results which will in time largely or completely obstruct the ureter. I present herewith the history of a case of double diverticulum in which this condition had gone on to such an extent as to produce the death of the individual. The history is as follows:

March, 1911. H. J. G. 38. Wagon Maker. Measles and inflammatory rheumatism 20 years ago. Thirteen years ago, attack of inflammation of the bladder lasting 3 days with frequent and painful micturition. Three years ago, passed blood following a blow on his side. Eighteen months ago had bloody urine followed by retention after a fall on the perineum. Habitually constipated. Several attacks amounting to obstipation. Four years ago, began to pass large quantities of urine, 14 to 16 pints. Three years ago, sugar was found and has been present since. Now passes three to four pints at a time. Comes in for pain in the right lower quadrant of the abdomen and in splenic flexure. Fairly developed, thin nervous man. Examination negative except for bladder distended to umbilicus. No sugar found. Bladder drained by catheter, small quantity at a time. Hæmorrhagic cystitis resulted. Is most comfortable when bladder is distended half

way to umbilicus. Remained in hospital one month. Temperature usually normal. Pulse average 96. Towards end of this time patient began to vomit and grow weaker. Bladder was kept empty and urine rarely below 40 ounces a day. He died—with symptoms of uræmia.

Pathological Report. Kidneys moderately enlarged and boggy. Renal tissue much thinned. Dilated pelves contain a large amount of rather thin purulent fluid. Ureters much dilated. Right circumference 5 centimeters. Left 6 centimeters. Bladder wall thickened and trabeculated. In the region of the opening of the right ureter is a diverticulum 4 centimeters in diameter which when distended presses on ureter. In the region of the left ureter is the opening of a large diverticulum about 10 centimeters in diameter. This opening admits the little finger. The opening into the left diverticulum is the left ureter. Distention of the diverticulum occludes the left ureter.

Diagnosis. Diverticula of bladder; cystitis. Pyonephrosis. Broncho-pneumonia of the right lung. Obsolete tuberculosis of the upper lobe of the right lung. Emphysema of lungs. Sero-fibrinous pleuritis of the right side. Gangrene of tissues of right thoracic wall following saline infusion. Anæmia.

Excision of Diverticulum of Bladder

In a recent case, a diverticulum of considerable size lay just above the left ureter which followed its lower margin and opened just at its orifice. In this case distention of the diverticulum produced a valve-like obstruction of the ureter which was much dilated and thickened. It was very apparent that had this condition been allowed to continue, extensive damage to or destruction of the kidney on that side would have occurred. The history of this case is appended.

May, 1912. M. G. 30. Factory. F. & P. H. negative. For past six months patient has had pain in bladder region with burning micturition. For past two months has occasionally

passed blood. Sometimes pain in back. Working or eating heartily seem to make pain worse. O. P. D. record. Bact. report March 26, 1912. Slight growth bacilli. Apr. 6, pig found dead. Too early for diagnosis of T. B. Cystoscopy, J. D. B. Residual 11 ounces. Bladder irritable. Mucosa red and œdematous. Ureters functioning. Jet from right (?) cloudy. Cystoscopy (J. D. B.). Residual 16 ounces. Directly in front of cystoscope to left of midline, round opening of congenital diverticulum with mucosa puckered around opening. Catheter with fuse wire inserted into diverticulum. X-ray shows diverticulum.

P. E. negative. Cystoscopy, Dr. Cabot. Large amount residual. Bladder washes clean without difficulty. 450 c. c. distention. In about position of left ureteral orifice, opening of large diverticulum. Ureter not seen. Cystoscope can be made to enter diverticulum. Operation, Dr. Cabot. Ether. Dorsal. Trendelenburg. Bladder washed and distended with boric. Median suprapubic incision. Bladder opened and diverticulum explored with finger. Peritoneum opened and left ureter dissected free and suspended with tape. Peritoneum stripped off bladder. Intestines walled back. With finger in diverticulum this structure was dissected free. No peridiverticular inflammation. Diverticulum opened. Ureteral orifice not seen, so ureter opened about 3 inches from bladder and probe passed through it to bladder. Ureteral orifice located in bladder proper about one-half inch from neck of diverticulum. Diverticulum about size of orange extended downward toward prostate, carrying before it the left ureter. When diverticulum was distended it pressed upon bladder orifice of ureter, tending to close it. Ureter was distinctly hypertrophied and dilated to size of large lead pencil. Diverticulum communicated with bladder by opening which would admit two fingers and appeared to be covered with extensions of all coats of bladder. It was removed at its junction with the bladder and aperture closed with catgut, the mucosa and muscular layer being closed separately. Opening

in ureter closed with fine catgut. Sponge count correct. Peritoneum and bladder. Wound closed to wicks with catgut and silkworm gut. Catheter through urethra. Patient doing well but troubled somewhat by a rather diffuse bronchitis with some pleurisy. Very slight leakage of urine from suprapubic wound due to blocking of catheter. No leakage. Catheter out. Voids O. K. No residual obtained. Wound cleaned and granulating strapped. Patient has developed marked phlebitis of whole of left leg. No. T. R. & P. Phlebitis much better. Wound appears solid. Very small granulating area. When dressing was changed to-day, nearly one ounce of necrotic material came from opening about one-eighth inch in diameter, in site of drainage wick. Opening gently dilated and sinus found to extend for nearly three inches along line of drainage wick. No reaction whatever. Wound again practically dry to-day.

Effects Arising from the Inability of the Diverticulum to Empty Itself Completely and Therefore its Great Liability to Infection

It is not clear whether these diverticula are in their early stages capable of emptying themselves and are therefore harmless, or whether they are more or less continually the site of residual urine. In the cases that have come under observation, the ability to completely empty themselves has, as a rule, been lost and it is frequently, for this reason, that they require medical care. Nothing except some other condition requiring close scrutiny of the bladder would otherwise lead to their discovery. It must be clear that if urine remains in them more or less continually, they are exposed to the same probability of infection as the obstructed bladder. We all of us, I think, believe that urinary retention is one of the commonest, if not the commonest, cause of cystitis and inflammation of a diverticulum must follow substantially the same course. Many of the cases which we have seen have attracted

attention because of evidence of urinary infection. Further examination showed that residual urine was present, frequently at an age when obstructing lesions of the prostate do not occur and the investigation thus started led to their discovery.

The following case is more or less typical of this class:

Oct., 1909. L. L. 28. Furniture business. Two years ago had an acute urethritis which was very persistent, involving the prostate, and has left him with a cloudy urine. Has been efficiently treated but cloudy urine still remains though it causes no symptoms.

Seen in August, 1909, with Dr. M. E. P. Fitzgerald. Both vesicles found distended and prostate rather irregular, which was thought to account for his condition. In Sept. seen again and found to have persistent residual of about 5 ounces. Operation suggested. An attempt to pass cystoscope in the office was unsuccessful. Condition believed to be one of contracture of the neck of the bladder. October 30. Operation. Ether. Under an anæsthetic, cystoscope passed with some difficulty and shows the opening of a diverticulum on the right lateral wall of the bladder which will undoubtedly account for cloudy urine. A suprapubic extraperitoneal cystotomy was done. Orifice of diverticulum found to admit the finger and the sac lay on the right lateral and inferior wall of the bladder. The peritoneum was then stripped off from the right and posterior bladder walls. Peritoneum torn a little at the point of attachment of the urachus. The diverticulum which had previously been packed with gauze was readily found at its upper border and the opening proved to be practically at its highest point. The neck of the diverticulum was divided extraperitoneally and the bladder wall at this point closed with interrupted catgut sutures. The sac thus isolated from the bladder was then freed by blunt dissection and removed. At its lower border it was in contact with the rectum and upper part of the prostate. The ureter though not seen was

found, by passing a ureter catheter, to lie upon its lower and outer walls and was not damaged. Bladder wound closed snugly around a medium rubber drainage tube with a Gibson stitch. Abdominal wall closed in layers above and below tube. Protective tissue drain to the right lateral wall of the bladder.

November 2. Drainage has been entirely satisfactory. No leakage around tube until to-day when it was removed.

November 7. There has been very little leakage from wound which is now practically tight. Urine passed freely. There is apparently a little residual urine. Seen in Jan., 1911. Urine normal. No residual. No symptoms.

DISCUSSION

Dr. Eugene Fuller, of New York: I think this an extremely interesting subject. I agree with Dr. Cabot about these conditions being probably at times congenital, or certainly in certain cases we do not seem to find anything in the way of obstruction at the urethral outlet to account for them.

I had a case at my clinic some time ago of a man who clinically seemed almost normal. He had nothing especially apparently the matter with him. He was cystoscoped, and an extreme amount of diverticula was found. Bands that looked almost like trabeculation. We could find nothing in the way of obstruction to account for this existing condition.

Some time before that I saw a man with extremely foul urine, without any evidence of obstruction. He had two or three large diverticula which were filled with soft, pasty, phosphatic calculi.

I have sometimes wondered whether this condition was analogous to the multilocular cystic conditions of the kidney. Whether a similar agency applied to the bladder caused such a condition to develop in connection with the bladder wall.

I would disagree with Cabot about this condition being so easy to manage. Of course, where you have one cyst you can dissect it out, but it is a question whether the bladder, on account of this dyscrasia, will not develop more.

Dr. A. L. Chute, of Boston: I am in accord with Dr. Cabot except as regards etiology. I see no reason to back water on my former views.

It seems to me that it depends on the depth of these little congenital things. I have measured two that went in about a quarter of an inch. It seems to me that it depends on the depth of these things whether they form from natural causes. For instance, take one that is nearly through the muscular wall, and it seems to me perfectly conceivable that the force of the contraction of the bladder alone against this place where the muscular fibers are defective is sufficient to start that thing going. I do not think one need have obstruction in the urethra to do it. I think that the other is perfectly conceivable.

DR. R. F. O'NEIL, of Boston: I wish to add one more case to the number of diverticula discovered in the course of routine examination in chronic urethritis. I recently cystoscoped a patient who had been treated for a long time for chronic prostatitis. This he had to a moderate degree, with a slightly cloudy urine. The cystoscope showed one of these small diverticular openings in close relation to the left ureteric orifice. I think it not at all unlikely that this was the cause of the continued cloudy urine.

DR. HUGH H. YOUNG, of Baltimore: This is certainly a very interesting subject. The more I see of diverticula, the more I am convinced of the fact that most of them are associated with obstruction of some sort. I have had three or four cases in men under 30 years of age. One of those cases had had a diverticulum removed elsewhere. When he came to me he had fifty cubic centimeters of residual urine, although the diverticulum and kidney on that side had been removed by a competent surgeon. He continued to have obstruction, and it was necessary to do a Bottini operation on him. In another case I removed a very large diverticulum, transplanted the flap containing the ureter into the bladder, and got no result there at all until I had done a Bottini operation to destroy the bar and remove the obstruction to urination. In the past year I have had two similar cases, both in young men, with large diverticula, one in the right half, the other in the left half of the bladder, each associated with prostatic enlargement, and all the cases I have seen in young men were associated with definite obstruction from prostatic enlargement.

I think congenital diverticula are due to congenital obstruction to urination somewhere, and that in the great majority of cases they are produced during fœtal life. I think English's view was that they are produced during fœtal life as a result of obstruction, and that in cases

where you do not find obstruction there was a temporary obstruction from failure of the urethra to open up.

Of course, some of these cases ought to be operated on, but the great number of cases that we see associated with enlarged prostate, where you do not dare to do an operation on the diverticulum, will go along perfectly well afterward, and this fact leads me to take a conservative view in regard to them, and all the more because those situated posteriorly are often very closely adherent to the pelvic wall and rectum and extremely difficult to remove. Others, I admit, ought to, and can quite easily, be removed.

DR. CABOT: I am sorry that I cannot agree with the theory of obstruction in the production of these cases, because if that were the explanation of all the cases, or anything like all the cases, removal of the diverticulum should not be followed by emptying of the bladder. Here are three cases, to which I could readily have added three others, in which the bladders were completely emptied following the removal of the diverticula, in which there was no evidence of obstruction and there has been none since. That seems to me effectively to dispose of the general proposition that those are the result of obstruction.

The view of English, to which Dr. Young has alluded, is an explanation to fit a theory and not to fit the facts. I am unable to furnish an embryological explanation, but I wish Dr. Binney would testify on this point, for I think he has some evidence concerning buddings from the cloacal membrane, and it seems to me likely that there we shall find the explanation.

There was one case, in connection with the cases reported by Dr. Squier, that interested me. It was that of a patient with an enlarged prostate whom we cystoscoped for the purpose of ascertaining which route we should employ, and whose prostate we removed, but who had no benefit from the removal of his prostate, because we had overlooked a large diverticulum, which seemed to me to be the cause of his obstructive symptoms. Up to the present time I have not operated for his diverticulum, but I am strongly inclined to the view that had we operated upon his diverticulum and not upon his prostate the symptoms would have been relieved. The prostate is removed and he does not empty his bladder. I am not at all clear that in this specimen presented by Dr. Squier the diverticulum was not primarily the cause of the symptoms rather

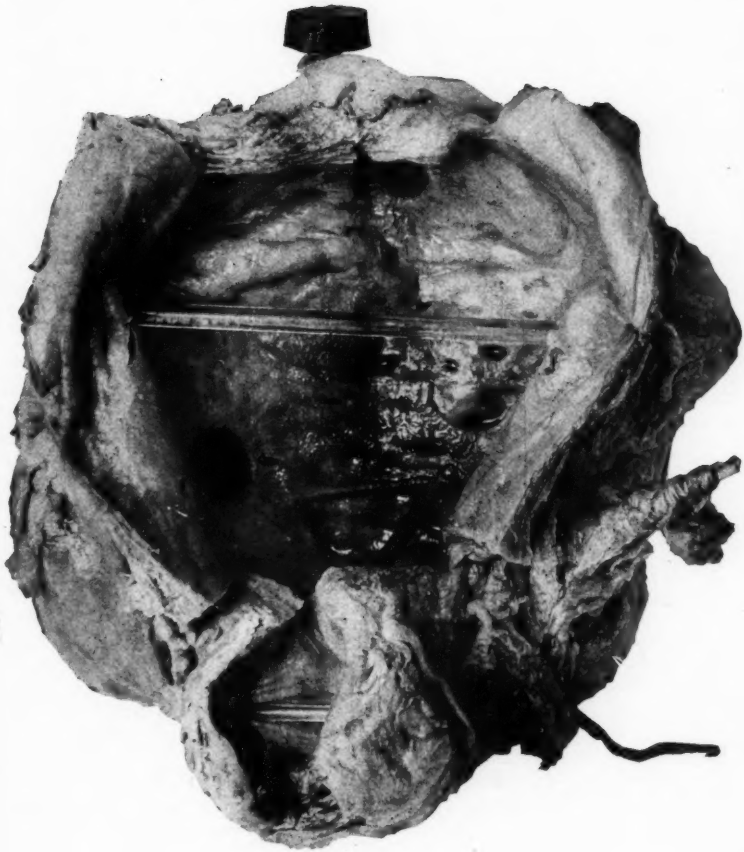
than the prostate; his prostate developing as concomitant of his difficulties and not as the primary cause.

DR. HORACE BINNEY, of Boston: The evidence that Dr. Cabot spoke of is meager, but I will state what it is. In reading up the anomalies of the kidney and ureter I found an article by Dr. George S. Huntington, read in 1907, on anomalies of this kind, which seems to bear on this point. He showed an illustration of the bladder in a case where the ureter and kidney were lacking on one side, and immediately in the region where the ureteral opening should have been there was a very distinct bud on the bladder wall, as he described it, which corresponded very closely with the diverticulum which Dr. Cabot described. The case was, I think, found at autopsy in an infant, and the thing was naturally very small. I do not know what the structure of that bud was, whether it contained all the tissues of the bladder wall or not. It merely suggested that an anomaly apparently in the development of the Wolffian duct on that side resulting in the formation of this bud, may bear some analogy to buds in the wall of the bladder resulting in the formation of diverticula.

DR. YOUNG: One young man, aged about 22, came to us with a mass in the left side of his pelvis. I cystoscoped him; found a lot of difficulty in introducing the cystoscope, but finally got it in. I found the orifice of a diverticulum, extremely large, in the left half of the bladder. He had a double nephritis, and died before long without any operation. In the study of this case we felt it was clearly proven that that was a case without any obstruction at all—no prostatic bar or anything of the sort. We got an autopsy, and we found in his urethra a bridle, or valve, balloon-like in character, extremely thin, which ran from the verumontanum to the roof of his urethra; and I believe that some of these cases that have not been discovered have been cases where through instrumentation this thin thing has been broken down. Certainly this case must have been due to this anomaly in the posterior urethra.

DR. J. BENTLEY SQUIER, of New York: I desire to present a specimen of multiple diverticula of the bladder in lieu of discussion. It represents a most marked example of this form of bladder degeneration. It was removed from a patient who had been upon catheter life for five years and who died from suppurating pyelitis. (See Plate IV.)

PLATE IV. — Presented by Dr. J. Bentley Squier



A PERINEAL METHOD FOR EXCISING OR DRAINING THE VESICLES

By Hugh H. Young, M. D., of Baltimore

IT is possible to expose the seminal vesicles through perineal incisions of various types, and to reach them by the same exposure used in prostatectomy, and in quite a few cases of chronic prostatitis in which I have removed part of the lateral lobes of the prostate I have also excised a portion of the seminal vesicles. In some of those cases in whom the seminal vesicles were rather deep and in which the prostate was not involved, it seemed unnecessary to do a prostatectomy and for such cases I have recently constructed a long tractor, No. 23 French in size, which can be easily introduced through the anterior urethra.

The procedure is simply to use the same incision as in a perineal prostatectomy—if you wish the incisions may be made a little longer. Then after exposing the bulb, levator-ani muscles and central tendon of the perineum, you come down on this instrument which has previously been passed as far as the prostatic urethra. The instrument in that position shows you where the membranous urethra is. Having gotten your landmarks, but without opening the urethra, you pass the instrument into the bladder and open it up as in a prostatectomy, except that it comes out through the meatus instead of through the perineum. Then the instrument is used to draw the prostate and seminal vesicles down. When an orderly simply pries downward, using the symphysis as a fulcrum, it is possible to bring the seminal vesicles up very close to the perineum in cases where they are not tremendously adherent, and it is quite easy to get at them. You can indistinctly see the outline of the ampulla of the vas and the seminal vesicle through the fascia covering them. You make your incison then depending on what you want to

attack. If you want to expose one side, you make an incision over that side. If you want to expose both you may make a median incision and stripping the fascia to each side expose both seminal vesicles, and either incise them or excise them more or less completely. Where the inflammatory infiltration around the seminal vesicles is very great, the mass is simply opened on each side and thoroughly drained. If the prostate is considerably involved it is wise to open and sometimes to excise tissue on both sides. The fact that this instrument makes possible a good exposure of the seminal vesicles without opening the urethra is its chief value.

DISCUSSION

DR. EDWARD L. KEYES, JR., of New York: I would like to ask Dr. Young wherein consists the advantage of using this new instrument of his (other than the advantage to his instrument maker) over the familiar tractor. I have used his prostatic tractor for the purpose of exposing the seminal vesicles. I fancy I pulled down, rather than bent over, as he now suggests, and I must say that I found it a most useful instrument. It brought the vesicles down into view very well.

I also operated upon a case of tuberculosis. I attribute part of the bad result that I got to the fact that I put the tractor through the membranous urethra in the usual way. I had not suspected tuberculosis, but the event proved this, and the urinary fistula remained open.

It seemed to me that the next best thing to do would be not to use any tractor at all. So that the next case in which I exposed the seminal vesicles through the perineum I did not use a tractor, and although I managed to disclose and remove them entire, nevertheless it was a very much more difficult operation than when I had used the tractor.

Since that I have concluded that if I were ever rash enough to do that operation again, it might be feasible to disclose the prostate in the usual way, and then make a hole in the anterior part of the bulb and insert the tractor and then cut, hoping that a wound that far forward could be kept clean of infection from the tuberculous prostate and seminal vesicles.

DR. J. BENTLEY SQUIER, of New York: I would like to ask Dr.

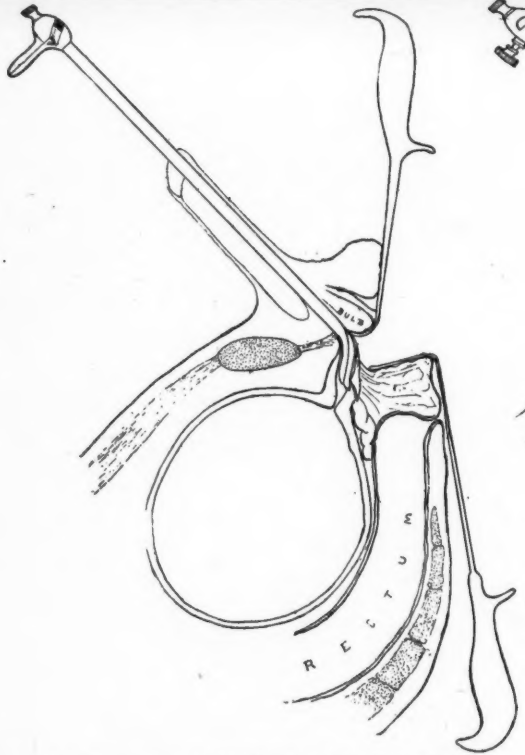


Fig. 1. Exposure of membranous urethra and apex of prostate, the long tractor in urethra and as yet unopened.

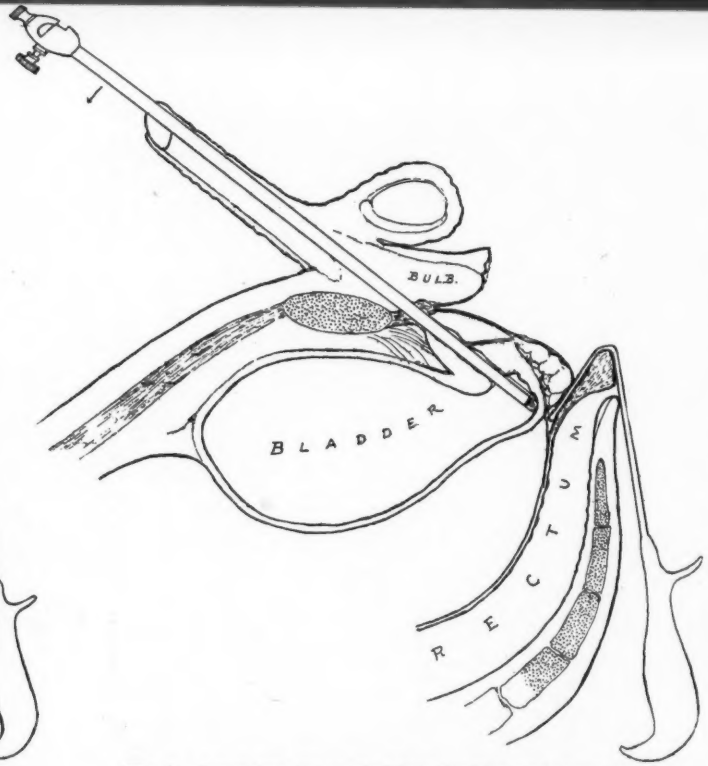


Fig. 2. Long tractor carried into bladder and opened out; traction and depression made on outer end of tractor, bringing the seminal vesicle into the wound.

Young what advantage the instrument gives him over putting a clamp in the prostate and pulling it upward? I have done that in five cases, and it gives a very perfect exposure of the vesicles through your incision.

DR. YOUNG: I have used the scheme which Dr. Keyes mentions, viz.: making the incison in the bulbous urethra, passing an ordinary tractor in there and bringing the prostate down. Of course, it is not ideal to make any useless incision. It is simply largely for doing away with this incision in the urethra that I use this new long tractor. And really you get better leverage with a longer lever.

This instrument takes the place of a sound that you would ordinarily use in the posterior urethra to tell you when you are nearing the membranous urethra, and then passing it on into the bladder, in order to tell you when you are close to the bladder in operating upon the seminal vesicles. I have found it quite helpful to rotate the blades and palpate the bladder in cases with considerable infiltration where I feared cutting into the bladder. Dr. Fuller spoke of getting into the bladder several times in his cases. This instrument in the bladder is a valuable index as to where you are, and the leverage that you get is preferable to forceps which are imbedded in the structure of the prostate and which may tear out.

DR. SQUIER: I would like to ask Dr. Young what experience he has had with this operation in draining the vesicles or excision of the vesicles for conditions other than tuberculosis?

DR. YOUNG: I have not operated on any tuberculous case with it. The only cases I have done have been cases of inflammation of the seminal vesicles.

Second Day, June 8th, 1912

RESULTS OF THE COMPLEMENT FIXATION TEST FOR GONORRHŒA AT THE MASSACHUSETTS GENERAL HOSPITAL

By R. F. O'Neil, M. D., of Boston

THE antigens used in the great majority of the tests were made from mixtures of cultures of gonococci from 3 to 11 different patients. The method of preparing the antigen which has seemed most practical consists in scraping off the twenty-four hour surface growth on hydrocele agar, suspending it in sterile normal salt solution and then allowing the micro-organisms to disintegrate in this, during some days or weeks while being kept in the ice chest. The tests were all made by Dr. James Homer Wright, the Director of the Pathological Laboratory. This series covers 256 tests on patients treated in the house and out-patient departments, and a few private patients of members of the staff. The reactions are described as negative, weakly positive, moderately positive, and strongly positive. In the general summary here given, however, the reactions are grouped as being negative or positive. When a reaction has been said to be suspicious it has been classed as positive. The cases have been divided anatomically into the following groups:

(1) Urethral (in the general summary, the cases of vaginitis, vulvo-vaginitis, cervicitis, etc., are included in this class).
(2) Arthritic.
(3) Pelvic (pus tubes, pelvic abscess and other lesions).

There were also a number of patients from the wards with various general medical and surgical lesions where the test

was made, without reference to gonorrhœal history. There are two cases of iritis and seven volunteers with no gonorrhœal history.

The urethral cases (exclusive of the cases of vaginitis, etc.) of which there were the greatest number (119) were divided into three classes. First those clinically positive, where definite lesions were present as prostatitis, vesiculitis or stricture, etc. Gonococci were not demonstrated in many of these cases, but all had gonorrhœal history. Second, those which were clinically negative, showing no signs at the time of making the test, and third, those clinically doubtful which included the perplexing cases so often met when there is an occasional watery discharge, a few shreds in the urine, or a few leucocytes after prostatic massage. Of the first, or clinically positive, there were 60 cases, the blood being positive in 50. The 10 cases where the blood was negative were mostly cases of prostatitis of long standing, the gonorrhœal infection being remote.

Of the clinically negative there were 30 cases, 21 showing a negative reaction; of the 9 showing a positive reaction, one is described as slow, one as suspicious, 6 as weakly positive. In 5 of these the gonorrhœal infection was recent, that it, within a few months, one case showing a moderately positive reaction, claiming to have had a chemical urethritis only, as he had used a strong injection after exposure. This case, I think, is open to doubt. There were no strong positive reactions.

Of the doubtful or borderline cases there were 27, 18 showing a positive, and 9 a negative reaction.

Of the lesions of the lower female genital tract there were 48, 24 clinically positive and 24 clinically negative. Clinically negative in this group means that the cases were negative at the time of making the test, not all had a history of gonorrhœa. There was but one positive blood, a case of vaginitis supposed to have been cured six months before.

Of the clinically positive, a little less than half showed gonococci, but all showed discharge from the cervix or vagina

or inflammation of Bartholin's glands. There were but three negative bloods, one of which had been previously positive.

There were 25 cases of arthritis. Ten of these had evident gonorrhœal genito-urinary lesions. All but one of these gave a positive reaction. In this case there was a moderate prostatitis of long standing. There were 4 cases with a history of gonorrhœa, the genito-urinary tract being negative at the time of making the test, of which 2 gave positive, and 2 negative reactions. There were 6 cases of doubtful gonorrhœal history with 3 positive and 3 negative. One of the positive cases is of interest, it being a case of injury to the wrist, in which an X-ray examination was negative to fracture, but was said to be suggestive of Neisser infection.

There were 5 cases of arthritis supposed to be due to other causes. 4 of these were negative, 1 positive in a case of polyarthritis in a woman associated with alveolar abscess, without history or evidence of gonorrhœa.

Of these 25 arthritic cases, 14 had gonorrhœa or a gonorrhœal history, the blood being positive 11 times and negative 3 times. 6 cases had a doubtful history, with 3 positive and 3 negative reactions. Of 5 with a negative history 4 were negative and 1 positive.

There were 20 cases of pelvic disease, of these 12 were positive to gonorrhœa at the time or giving a history of gonorrhœa, most of them being acute salpingitis with operation, and all gave a positive blood reaction. There were 5 clinically doubtful cases, giving 4 negative and 1 positive reaction. Three were absolutely negative, all giving negative reactions.

The 2 cases of iritis were negative, although both had a history of gonorrhœa. The genito-urinary tract was also negative.

In 13 cases from the general medical wards, 8 showed a positive reaction. All of these gave a venereal history, although in some cases it was quite remote. The reactions were all moderately positive, except one which gave a strong posi-

tive one. This case was one of specific aortitis, which died. Autopsy showed a salpingitis. In 22 general surgical patients there were only 3 moderately positive reactions. There was no gonorrhœal history in any of these. In the other 19 the histories state no gonorrhœal evidence.

The 256 tests may be summed up in general as follows:

		Positive	Negative
Cases with gonorrhœal history which are clinically uncured	109	95	14
Cases of gonorrhœa in which cure is doubtful	27	9	18
	136	104	32
Cases where the diagnosis of gonorrhœa is doubtful	16	5	11
Negative to gonorrhœa history	17	0	17
Negative to gonorrhœa by examination at time of test	0	0	0
History of gonorrhœa in most cases	52	9	43
	69	9	60
Cases from the general service	35	11	24
	256		

These last 35 cases are interesting but are not included in this series as the information in regard to the condition of the genito-urinary tract is insufficient.

The following tables give the cases more in detail and it will be seen from them that as a general rule, the tests correspond very closely with the clinical findings:

URETHRAL CASES

Clinically Positive with Positive Blood

			Blood.
1	M.	Epididymitis.	Positive.
2	B.	Discharge. Cloudy urine.	Positive.
3	J.	Smear moderately positive. First urine turbid. Acute exacerbation.	Positive.
4	F. B.	Smear moderately positive. Discharge. Urine cloudy (8 days).	Positive.
5	H. B.	Discharge. Urine cloudy with shreds.	Weakly positive.
6	B.	Urine shreds. Some *détritus* after massage.	Moderately positive.
7	C.	Urine cloudy.	Weakly positive.
8	W.	Slight discharge. Gonococci 5 days before. Urine cloudy. (Acute case.)	Suspicious.
9	S.	*Détritus* after massage. Epididymitis.	Weakly positive.
10	J	Urine hazy under massage treatment.	Moderately positive.

11	B.	Urine hazy.	Moderately positive.
12	M.	Discharge and cloudy urine.	Moderately positive.
13	O'B.	Epididymitis. No other symptoms.	Positive.
14	F.	Dec. 22, 1911. Gonococci present. (3½ months later negative.)	Positive.
15	P.	Urine cloudy. *Détritus* after massage.	Weakly positive.
16	B.	Urine cloudy with pus. No gonococci found.	Moderately positive.
17	A.	Gonorrhœa 1½ years ago. A. M. drop for long time.	Moderately positive.
18	H.	Urethritis and epididymitis.	Weakly positive.
19	A.	Chronic urethritis and stricture.	Positive.
20	V.	Anterior and posterior gonorrhœa. Gonococci present.	Positive and moderately positive.
21	M.	Urine number of large shreds. Prostatitis.	Positive.
22	H.	4 years moderate discharge.	Weakly positive.
23	C.	Epididymitis.	Positive.
24	D. R.	Discharge. (Coarse and fine shreds.)	Positive.
25	Dr. L.	Posterior case 14 weeks. Shreds in both ureters.	Positive.
26	J. W.	Persistent shreds.	Positive.
27	J. B.	A. M. discharge and persistent shreds.	Weakly positive.
28	J. W. S.	At times discharge. Many shreds in urine.	Positive.
29	W.	Chronic prostatitis.	Weakly positive.
30	N.	Prostatitis with *détritus*.	Weakly positive.
31	S.	Stricture with prostatitis.	Weakly positive.
32	E. L. C.	Morning drop. Gonococci present, May 16, 1911. Prostate normal May 15, 1912.	Weakly positive.
33	A. C.	Gonorrhœa several times. Urine cloudy. Pus from prostate.	Weakly positive.
34	P. C.	Gonorrhœa. Epididymitis. Urine many shreds.	Positive.
35	T. D.	Gonorrhœa 6 mos. ago. Urine shreds. Creamy discharge.	Positive.
36	D.	Gonorrhœa, Oct., 1911. Now pus from prostate. Urine clear on March 14, 1912.	Positive.
37	S. G.	Dec. 5, 1911. Gonococci found in pus from prostate.	Positive.
38	P. B. I.	Gonorrhœa and epididymitis one year ago. (April 12, 1912.) At present pus from prostate.	Positive.
39	J. W. O.	Smear shows gonococci.	Positive.
40	J. K.	Dec. 24, 1911. Abscess of prostate. Test negative. Mar. 23, lump still in prostate. Some pus in secretions.	Weakly positive.
41	E. M. S.	Morning discharge. Urine shreds.	Weakly positive.
42	A. K.	No discharge. Shreds look suspicious.	Positive.
43	W.	Gonococci present, Dec. 5. Dec. 30 no discharge. Urine clear with shreds.	Positive.
44	W. F.	Clinically positive. Urine shreds. Gonorrnœa for long time.	Weakly positive.
45	W. R.	Slight moisture at meatus. First urine hazy, with shreds. Second urine cloudy.	Weakly positive.
46	F. S.	Moderate prostatitis. Stricture large calibre.	Weakly positive.
47	B.	Urine cloudy with shreds. Massage of prostate much fine *détritus*.	Weakly positive.

48	C.	P. P. D. Gonococci present, duration 11 days. Anterior case.	Weakly positive.
49	H.	Prostatitis. Vesiculitis.	Suspicious.
50	F. K.	Gonorrhœa 2½ months ago. Prostate much indurated.	Weakly positive.

URETHRAL CASES

Clinically Positive with Negative Blood

			Blood.
1	B.	Discharge. Urine cloudy.	Negative.
2	O'B.	Discharge with gonococci. Urine turbid. (Anterior case only.)	Negative.
3	S.	*Détritus* after massage. Stricture Dec. 12, 1911. Said to be free from symptoms May 2, 1912.	Negative.
4	C.	Slight discharge after massage. Pus in prostatic secretion. Gonorrhœa one and two years ago.	Negative.
5	K.	Urine cloudy with shreds. Gonorrhœa 1½ years ago.	Negative.
6	C. (See No. 4)	Still shows pus from prostate.	Negative.
7	S.	Gonorrhœa 1 year ago. Now has glete.	Negative.
8	J. A.	Urine shows many shreds. (6 year old attack.)	Negative.
9	C.	Urine clear. Some sticking at meatus. Slight *détritus* after massage.	Negative.
10	B.	Some discharge. Prostatitis with *détritus* after massage. No gonococci on record since 1904 (7-8 years ago).	Negative.

URETHRAL CASES

Clinically Negative with Negative Blood

			Blood.
1	B.	One year after attack. Few shreds after massage.	Negative.
2	G.	Clinically cured. (Was positive 2 months ago.) Nothing from massage. Urine cloudy.	Negative. (Weakly positive?)
3	F.	Phimosis with pus. (3 weeks.)	Negative.
4	R.	Gonorrhœa 3 years ago. Clinically well.	Negative.
5	M.	Slight discharge from prostate. Clinically well.	Negative.
6	R.	Prostate massage negative.	Negative.
7	Z.	No signs for 10 years.	Negative.
8	K.	No evidence of gonococci.	Negative.
9	J.	No evidence of gonococci.	Negative.
10	B.	No evidence of gonococci.	Negative.
11	A.	Clinically cured.	Negative.
12	T.	Chronic urethritis. Prostatic massage negative.	Negative.
13	G. H. R.	Urethritis several years ago. Urine clear. No symptoms.	Negative.
14	B. P.	Gonorrhœa some time ago. Clinically negative. Urine clear.	Negative.
15	J. G.	Clinically negative.	Negative.

16	S.	Urine cloudy. Massage negative. No symptoms.	Negative.
17	V.D.C.B.	G. U. tract normal. Spasmodic stricture?	Negative.
18	S.	Clinically negative. Meatotomy.	Negative.
19	G.	Clinically well. No discharge. Urine clear. Nothing after massage.	Negative.
20	Dr. B.	Urethritis 6 yrs. ago. Clinically well.	Negative.
21	S.	Clinically negative. Prostatitis.	Negative.
22	O.	Clinically negative. Prostatitis.	Negative.
23	P.	Prostatitis. Clinically negative.	Negative.
24	V.D.C.B.	Spasmodic stricture. No gonococci.	Negative. (Done twice.)

URETHRAL CASES

Clinically Negative with Blood Positive

			Blood.
1	S.	Clinically well. Massage negative.	Weakly positive. Negative.
2	M.	Clinically negative.	Negative. Slow.
3	M.	Clinically negative. Claims to have had a chemical urethritis.	Weakly positive. Moderately positive.
4	N.	A. & P. urethritis with epididymitis and epididymectomy in Dec., 1911. No urethritis, no prostatitis Jan. 27, 1912.	Moderately positive.
5	E. C. C.	Anterior urethritis. No signs for 2 months.	Weakly positive.
6	J. S.	Attack 7 yrs. ago and 20 yrs. ago. Clinically well. No pus from massage Feb. 27, 1912.	Moderately positive.
7	B.	Findings clinically negative for some weeks. (Recent case.)	Negative. Suspicious.
8	484.	Clinical findings negative, May 8, 1912. Working since Dec. 1, 1911.	Weakly positive.
9	P.	Apr. 6, 1912. No symptoms. Urine cloudy. Massage negative. Gonorrhœa Jan. 10, 1912.	Weakly positive.

URETHRAL CASES

Clinically Doubtful, Borderline Cases. Blood Negative

			Blood.
1	J. W. B.	Gonorrhœa 2 yrs. ago (Oct., 1912). Treatment till Nov., 1911, then urine cloudy, rare pus cell from prostate. No symptoms Feb. 17, 1912.	Negative.
2	W. B. G.	Urine hazy. Prostate indurated. No pus in smear.	Negative.
3	G. O.	Slight mucoid discharge. Shreds. (Drinking.)	Negative.
4	W. D.	Several attacks. Thin discharge after drinking.	Negative.
5	A.	Slight moisture, few flakes. (Right on edge.)	Negative.
6	C.	Fine *détritus* after massage.	Negative.
7	S. C.	Flare up. Smear negative. Urine shreds. Used injection. (Chemical irritation?)	Negative.
8	G.	Massage of prostate shows few shreds, occasional wet meatus.	Negative.
9	J.	Few leucocytes in prostatic secretions. Few shreds. No gonococci for month.	Negative.
10	C. B.	Urine shows few fine shreds only.	Negative.

11	R. A.	Slight persistent moisture. Some shreds.	Negative.
12	C. R.	Few shreds in urine. Nothing after massage.	Negative.
13	G. W. L.	Slight discharge at times. Shreds in some.	Negative.
14	G.	Slight moisture. Urine clear. No visible discharge.	Negative.
15	V.	No discharge. Urine clear. Few shreds.	Negative.
16	R.	Urine clear. 1st few shreds. Massage negative.	Negative.
17	C. U.	Says he has occasional discharge. None seen. Urine clear with shreds.	Negative.
18	W.	Gonorrhœa 6 years ago. Still has some pus in urine.	Negative.

URETHRAL CASES

Clinically Doubtful, Borderline Cases. Blood Positive

			Blood.
1	V. S.	Urethritis supposed to be cured. For 4 months moisture. Smear, few shreds.	Weakly positive.
2	P. W. A.	Gonococci present 4 mos. ago (Dec. 1). May, 1912, Urine positive. Massage shows rare pus cells.	Weakly positive.
3	S.	Urine cloudy with occasional shred. Blood on Mar. 15 negative. On April 18, weakly positive. Patient has been having vaccines on May 14.	Negative. Weakly positive. Suspicious.
4	H.	Occasional shred in urine. Prostatitis for long time.	Weakly positive. Suspicious.
5	W.R.H.	Few shreds only. Nothing after massage.	Negative. Suspicious.
6	C. L. S.	Fine shreds.	Negative. Suspicious.
7	B.	Had an infection 4 months ago. Massage negative. Urine fine shreds.	Positive.
8	A.	Old chronic case, very little to be seen. No discharge. Few fine flakes after massage.	Negative. Suspicious.
9	W.	Urine clear, few shreds; had *détritus*.	Weakly positive.

VAGINITIS, ETC.

Clinically Positive

			Blood.
1	McD.	Smear positive. Bartholinitis.	Positive.
2	Von S.	Smear moderately positive.	Weakly positive.
3	H.	Smear moderately positive.	Weakly positive.
4	B.	Smear moderately positive.	Positive.
5	H.	Smear moderately positive.	Weakly positive. Later, negative.
6	G.	Clinically positive.	Positive.
7	A.	Clinically positive.	Positive.
8	C.	Clinically positive.	Weakly positive.
9	J.	Clinically positive.	Negative.
10	B.	Clinically positive.	Weakly positive.
11	M.	Smear positive.	Positive.
12	T.	Clinically positive.	Positive.
13	K.	Urethritis and vaginitis.	Weakly positive.

14	B.	Urinary symptoms. Suspicious case. Husband under treatment.	Weakly positive.
15	C.	2 years ago, gonorrhœal vulvo-vaginitis. Slight symptoms now.	Positive.
16	A.	Inflamed Bartholin's gland.	Weakly positive.
17	B.	Old vaginities with pus tube.	Weakly positive.
18	H.	Vulvo-vaginitis. Gonococci present Mar. 14. On May 15, slight symptoms.	Weakly positive.
19	M.	Vulvo-vaginitis. Clinically positive.	Weakly positive.
20	C.	Vulvo-vaginitis. Clinically positive.	Weakly positive.
21	McN.	Vaginitis. Clinically positive. Has had gonorrhœa.	Weakly positive.
22	K.	History of gonorrhœal cervicitis. Said to have arthritis.	Weakly positive.
23	H.	Pus from cervix. Operation for tube 2 yrs. ago.	Positive.
24	O.	Cervicitis. Gonococci found 4 months ago. None since.	Negative.

VAGINITIS, ETC.

Clinically Negative

			Blood.
1	N.	Smear and clinically negative.	Negative.
2	A.	Negative.	Negative.
3	B.	Negative.	Negative.
4	B.	Negative.	Negative.
5	Y.	Negative.	Negative.
6	T.	Negative.	Negative.
7	N.	Negative.	Negative.
8	D.	Negative.	Negative.
9	E. G.	Doubtful.	Negative.
10	O.	Clinically negative.	Negative.
11	C.	Clinically negative. Stricture and spasm urethra.	Negative.
12	M. C.	Clinically negative. Gonorrhœa 9 yrs. ago. Vaginitis.	Negative.
13	Miss R.	Vaginitis. Supposed to have been cured 6 months ago.	Moderately positive. Weakly positive.
14	Case 212	Vaginitis. Negative to gonococcus.	Negative.
15	E.	Negative to examination.	Negative.
16	R.	Some redness of vagina. Smear shows no pus.	Negative.
17	D. C.	Slight vaginal discharge. Smear negative.	Negative.
18	L.	Local condition negative. No gonorrhœal history.	Negative.
19	G.	Vulvo-vaginitis.	Negative.
20	R.	Local examination negative. History suspicious. Child with ophthalmia. Husband with gonorrhœa.	Negative.
21	T.	Leucorrhœa.	Negative.
22	W.	Clinically negative.	Negative.
23	C.	Has had vaginitis. No discharge at present.	Negative.
24	M.	Leucorrhœa. No gonococci found.	Negative.

IRITIS CASES

			Blood.
1	E.	No symptoms for one year.	Negative.
2	R.	Urine cloudy.	Negative.

PELVIC CASES

Pus Tubes, Pelvic Abscess, Etc.—Clinically Positive

			Blood.
1	R.	Clinically positive. Tubes.	Positive.
2	C.	Pus tube.	Weakly positive.
3	R.	Salpingectomy. Hysterectomy.	Negative.
4	B.	Salpingitis.	Weakly positive.
5	Mrs. S. E.	Pus tubes.	Positive.
6	S.	Acute salpingitis after normal delivery. O. P. Service. B. L. H. Gonococci or puerperal sepsis?	Negative.
7	P.	Acute pus tubes. No operation. (Patient left.)	Positive.
8	B.	Pus tubes. Pelvic abscess. (Operation.)	Positive.
9	S.	Salpingitis. Operation, uterus removed.	Weakly positive.
10	C.	Double Tubes. No mention of gonorrhœa in history.	Moderately positive. Weakly positive.
11	S.	Acute appendix. Acute tube. Tube not removed. No other gonorrhœal evidence.	Weakly positive.
12	McK.	Double pus tubes. Clinically gonorrhœa.	Positive.
13	Dr. M.'s Case	Acute pus tubes. Gonococci in pus and blood, also joints with temperature.	Positive.
14	H.	Operative case of pus tubes.	Positive.
15	Dr. B.'s Case	Operation for pus tubes. Persistent cervical discharge after operation.	Positive.

PELVIC CASES

Tube and Pelvic Lesions—Clinically Negative

			Blood.
1.	Mrs. C. R.	Operation for pus tubes.	Negative.
2	W.	Salpingitis? Some tenderness in cul-de-sac. Resistance on both sides. Smear negative.	Negative.
3	B.	Acute salpingitis secondary to ovarian cyst with torsion.	Negative.
4	S.	Double tubes, no gross evidence or history.	Negative.
5	T.	Pelvic peritonitis following delivery. No gonorrhœal evidence.	Negative.

ARTHRITIS

With Evident Genito-Urinary Lesions

History of Gonorrh@a Doubtful

			Blood.
1	S.	Gonorrhœa for 6 or 7 years. Stricture and prostatitis now. Subacute joints.	Positive.
2	B.	Chronic urethritis. G. C. rheumatism.	Positive.
3	P.	Prostatitis. Joints.	Weakly positive.

4	McL.	Small amount of prostatic *détritus*. Joints.	Negative.
5	McP.	Prostate tender. Joints.	Positive.
6	V.	Gonorrhœa locally. Gonorrhœal joints. Positive clinically.	Positive.
7	C.	Gonorrhœal arthritis. Urine contains shreds.	Weakly positive.
8	K.	Gonorrhœal arthritis. Positive clinically. Second attack of gonorrhœa.	Positive.
9	De F.	Multiple arthritis with pelvic condition.	Positive.
10	L.	Positive gonorrhœal arthritis.	Positive.

ARTHRITIS

Genito-Urinary Tract Negative at Present Time

History of Gonorrhœa

			Blood.
1	T.	Urethritis 4 years ago. G. U. tract clinically negative. Some trouble with ankle.	Negative.
2	Case of Dr. D.	Old history of gonorrhœa. G. U. tract negative. Limitation of motion of elbow.	Weakly positive.
3	N.	History of gonorrhœa. G. U. tract negative. Knees and ankles.	Negative.
4	N.	Obscure chronic rheumatism. Old history of gonorrhœa. G. U. tract at present time probably negative.	Positive.

Joint Lesions due to Various Causes

			Blood.
1	K.	Acute polyarticular rheumatism. History of sore throats, no gonorrhœal evidence.	Negative.
2	S.	Polyarthritis. Gonorrhœa 15 yrs. ago. Many sore throats.	Negative.
3	R.	Alveolar abscess. Polyarthritis. No history or evidence of gonorrhœa.	Moderately positive.
4	J.	Infections multiple arthritis. Only apparent cause "bad teeth."	Negative.
5	C.	Subacute arthritis ankle. No history of gonorrhœa. No evidence of venereal disease.	Negative.

ARTHRITIS CASES

			Blood.
1	K.	Knee.	Negative.
2	C.	Knee. Negative to gonorrhœa clinically.	Negative.
3	Y.	Pain about sciatic notch.	Negative.
4	M.	Acute polyarthritis. Denies any venereal infection. Some leucorrhœa. No other symptoms.	Positive.
5	F.	Infections arthritis. No history of venereal disease. Knee.	Moderately positive.
6	S.	Injury to wrist. No fracture by X-ray. (Condition suggests gonococcic lesion.)	Weakly positive.

GENERAL MEDICAL CASES

			Blood.
1	F.	Chronic nephritis. Arteriosclerosis. No evidence of gonococci.	Negative.
2	L.	Cardio-renal. No evidence of gonococci.	Negative.

3	G.	Cardio-renal. One year ago slight urethritis. Clinically cured.	Negative.
4	T.	Cardio-renal. Gonorrhœa and chancre 18 yrs. ago.	Weakly positive.
5	W.	Cardio-renal. Uræmia. Gonorrhœa 20 years ago.	Weakly positive.
6	C.	Cardio-renal. Anasarca. No venereal disease stated.	Weakly positive.
7	G.	Cardio-renal. Retinitis. Gonorrhœa 6 times, last 3 years ago.	Moderately positive.
8	McC.	Aortic aneurysm. Chronic nephritis. No gonorrhœal history but positive Wassermann.	Weakly positive.
9	F.	Cardio-renal. No gonorrhœal evidence.	Negative.
10	H.	Aortitis. Aortic regurgitation. Gonorrnœa several times.	Moderately positive.
11	L.	Cardio-renal. Bronchitis. Gonorrhœa 30 years ago. 58 yrs. old, stricture?	Moderately positive.
12	L.	Lobar pneumonia with pleural effusion. Gonorrhœa 2 years ago.	Negative.
13	G.	Positive Wassermann. Death. Autopsy showed old salpingitis.	Positive.

GENERAL SURGICAL LESIONS

			Blood.
1	K.	Osteomyelitis. (Staphylococci.) No gonorrhœal history.	Negative.
2	J.	Chronic appendix. No venereal evidence.	Negative.
3	C.	Pyonephrosis one side. Pyelitis. No gonorrhœal evidence.	Negative.
4	W.	Colon bacillus pyelitis. No gonorrhœal evidence.	Negative.
5	S.	Fracture. Lower leg. No gonorrhœal evidence.	Negative.
6	W.	Scars of face. No gonorrhœal evidence.	Negative.
7	B.	Retroversion. Suspension. No gonorrhœal evidence.	Negative.
8	K.	Retroversion. No gonorrhœal evidence.	Negative.
9	H.	Uterine fibroid. No gonorrhœal evidence.	Negative.
10	M.	Pregnancy. Pyelitis. No gonorrhœal evidence.	Negative.
11	W.	Tumor of vagina. No gonorrhœal evidence.	Negative.
12	G.	Ventral hernia. Lacerated perineum. No gonorrhœal evidence.	Negative.
13	W.	Fibroids. Hysterectomy. No gonorrhœal evidence.	Negative.
14	L.	Cancer of breast. No gonorrhœal evidence.	Negative.
15	G.	Gall stones. History of old pelvic abscess, non-gonorrhœal in origin.	Negative.
16	S.	Fistula in ano. Hæmorrhoids. No gonorrhœal evidence.	Negative.
17	D.	Abscess leg. No gonorrhœal evidence.	Weakly positive.
18	K.	Vesical fistula following typhoid.	Negative.
19	F.	Hæmorrhoids. No gonorrhœal evidence.	Negative.
20	S.	Double inguinal hernia. No gonorrhœal evidence.	Weakly positive.
21	O.	Acute mastitis. No gonorrhœal evidence.	Weakly positive.
22	D.	Acute appendix. No gonorrhœal evidence.	Negative.

FURTHER EXPERIENCES WITH THE COMPLEMENT FIXATION TEST IN THE DIAGNOSIS OF GONOCOCCUS INFECTIONS OF THE GENITO-URINARY TRACT IN THE MALE AND FEMALE

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(Read by Invitation)

IN a previous paper,[1] attention was drawn to the value of the serum diagnosis of gonococcus infections in general. We there showed that in chronic gonococcus infection, even though limited to the genito-urinary tract, an antibody specific for the gonococcus could readily be detected in the blood. Our experimental work showed that the secret of success lay in the use of a polyvalent antigen, on account of the fact that the different strains of the gonococcus seemed to differ considerably one from the other. So much so that the antibodies produced in the system by the toxin of one strain would in many instances not bind complement in the presence of an antigen prepared from another strain. As a result, if only one strain were used in the preparation of the antigen, a great many negative results would be obtained in positive cases. We showed further that the reaction was specific for the gonococcus with the sole exception of meningococcus infection, but we did not consider that this fact would detract from the practical value of the test, as there could be very little difficulty in distinguishing between the two infections clinically.

We then gave the results of the application of the test to a total of 324 human sera. These results showed that the complement fixation test (using a polyvalent antigen) for gonococcus antibodies, should prove an addition to our methods of diagnosing the various chronic conditions arising from gono-

coccus infection and similar conditions due to other causes. In addition we pointed out that the complement fixation test might be a distinct aid in finally deciding as to whether a patient was cured of his or her gonococcus infection, inasmuch as the blood test was positive in a certain percentage of cases where other means of diagnosis failed.

Finally, we stated that, in our opinion, the facts at hand seemed to prove conclusively that a positive reaction denotes the presence or recent activity in the body of a focus of living gonococci.

Technique

The antigen used at the present time is prepared as follows:

The Torrey strains of gonococci are grown on salt-free veal agar, neutral in reaction to phenolphthalein; twenty-four hour old cultures are washed off the agar slants with distilled water and the resulting suspension is heated for two hours in the water bath at 56° C. It is then centrifugated and passed through a Berkefeld filter. No salt is added to this antigen until it is desired to use it when it is made up to 0.9% strength by adding one part of 9% saline solution to nine parts of antigen.

The antigen is best preserved in small quantities in sealed tubes, heated to 56° C. for half an hour on three successive days to insure sterility. If possible, the antigen should be standardized with a known positive serum from a clinical case. If this is impossible, immune rabbit serum may be used provided that the minimum amount of the serum which will completely fix complement is used. An antigen titrated with a highly immune rabbit serum may show perfect fixation in an amount that would fail to show any fixation with the average clinical case on account of the lower antibody content of the latter. Antigens prepared as above will keep almost

indefinitely if kept in sealed tubes free from contamination. We now use only the anti-sheep hæmolytic system, but in other respects the technique is the same as described in our previous paper.

We may say that for the past few months we have used the gonococcus antigen prepared by Parke, Davis & Co., along with our own, and so far, it has given entirely satisfactory results.

Significance of a Positive and a Negative Reaction

As already stated, we found a positive reaction to be specific for the gonococcus with the sole exception of meningococcus infection.

A negative reaction does not, of course, exclude the possibility of gonococcus infection being present, in the same way as a negative Wassermann reaction does not exclude the possibility of syphilitic infection. In this connection, however, there are two facts to be taken into consideration. *First,* in the late lesions of syphilis, in common with the other infectious granulomata, there is a distinct tendency for the fibroblasts at the periphery of the lesion to develop into definite connective tissue cells. We may thus obtain the formation of a more or less well-marked connective tissue capsule surrounding the lesion. As a result, there is arrested activity on the part of the spirochætæ, a less amount of toxin is elaborated, the connective tissue capsule offers some resistance to the free absorption of toxins and, as a result, there may be a lessened antibody formation. This condition does not obtain in gonococcus infection as the lesions here do not tend to become encapsulated. *Secondly,* the Wassermann reaction is definitely obscured by recent mercurial treatment. There is no treatment which thus obscures the complement fixation test for gonococcus infections. On account of these two facts we think that more importance may perhaps be attached to a

negative reaction in testing for gonococcus infection than is to be attached to a negative Wassermann test for syphilis.

Time of Appearance of a Positive Reaction

A positive reaction is not to be expected earlier than about the fourth week of the disease and then only in very acute cases with some complication such as acute prostatitis, gonococcus arthritis, etc. For example, in one case of acute gonococcus arthritis coming on three or four days after the onset of the urethritis, the blood was negative (though very slowly) on the twenty-first day, and strongly positive on the twenty-eighth day from the first appearance of the urethral discharge. In another similar case, the blood was negative on the seventeenth day and strongly positive on the twenty-fifth day of the disease.

Time of Disappearance of a Positive Reaction After Cure

It is, of course, evident that the antibodies must persist in the blood for some time after the patient is actually cured. How long they persist is a difficult question to answer precisely. That they do not persist indefinitely we are quite certain. Torrey[2] has shown that the complement fixatives in the blood of a rabbit immunized to the gonococcus begin to be eliminated ten days after the date of the last inoculation and continue to be eliminated very rapidly from the tenth to the fiftieth day, after which they are only found in very small quantities.

Our own experiments with rabbits confirm these results. After the fiftieth day from the date of the last inoculation only a + reaction can be obtained. This is a reaction to which we attach no importance.

Clinically we have seen one case in which a + + reaction changed to a negative in five weeks after cure. The majority of cases, however, take somewhat longer. As a rule we think

a negative reaction should be obtained seven or eight weeks after cure. In other words, if a positive reaction is obtained seven or eight weeks after clinical cure, we think that the patient should be looked upon as still harboring gonococci. If the reaction is seen to become progressively weaker in a series of tests made at intervals of about two weeks, the assurance of cure might, perhaps, be given before the reaction becomes absolutely negative; unless, of course, the assurance of cure carries with it consent to marriage.

Relative Value of the Complement Fixation and Bacteriological Methods of Diagnosis

We wish to say a few words as to the relative value of the bacteriological and complement fixation methods of diagnosis in chronic and doubtful cases and also as to the technical difficulties connected with the two methods.

As we have already stated, the complement fixation test is specific for the gonococcus. A positive reaction must, therefore, be looked upon as absolute proof of a focus of gonococcus infection somewhere in the body. What constitutes absolute proof of the gonococcus bacteriologically? Certainly not a smear stained with methylene blue. A Gram stain, properly made, can be accepted where the gonococci are abundant, but in chronic cases with few organisms present, it cannot be accepted as absolute proof. Amongst the sources of error may be mentioned the micrococcus catarrhalis; degeneration forms of Gram positive cocci which not infrequently do not retain the Gram stain; and according to Adami[3] the Trichomonas vaginalis and some aberrant forms of the Bacterium Coli. All authorities are agreed that in doubtful cases culture methods constitute the only absolute proof.

There is little doubt that the technique of isolating the gonococcus in culture is far more difficult than the technique

of a complement fixation test. In the first place, the bacteriologist may err as Dr. E. L. Keyes, Jr.,[4] well says "through his own fault or through the fault of the clinician who submits the specimen to him, and the precision of his diagnosis depends upon a well prepared specimen as much as upon his own skill." The prostate and vesicles must be thoroughly massaged and the specimen must be fresh, as it is very probable that the gonococcus cannot be cultivated if allowed to stand in cool urine for half an hour. In addition, the gonococcus grows only on special media and culture may fail on account of the presence of other rapidly growing organisms which either inhibit the growth of the gonococcus or render its isolation impossible. This is especially the case in women.

In connection with the complement fixation test, the only real difficulty lies in obtaining and carrying the various strains of the gonococcus necessary for the preparation of a good antigen. Apart from this, if the serologist carefully and frequently titrates the various reagents used in the test—a matter neither difficult nor time-consuming—the technique of the complement fixation test is comparatively simple.

All the above facts must be taken into consideration in judging as to the relative value of the bacteriological and complement fixation methods of diagnosis. In the presence of a positive complement fixation test and negative bacteriological findings, we think the fixation test should be accorded its full value. In the presence of a negative complement fixation test and positive bacteriological findings, we think the bacteriological findings should be accepted as correct only if the proof is absolute; namely, isolation of the gonococcus in culture.

In connection with the above statements the limitations of the complement fixation test, to be detailed later are, of course, to be borne in mind. In all cases we think that in the interests of the patient, both methods of diagnosis should be used.

I. Gonorrhœal Urethritis—Gonococci Present

No. of cases	Duration			Reaction
3	2	weeks	.....	—
1			.....	—
4	3	"	both urines cloudy.....	+
1	4	"	both urines cloudy.....	+
1	4	"	marked prostatic involvement.....	+ + +
2	4	"	gonococcus arthritis 3 weeks.....	+ + +
1	5	"	both urines cloudy.....	+
2	6	"	both urines cloudy.....	+
1	7	"	prostatic abscess	+ +
2	8	"	both urines cloudy.....	+ +
1	8	"	prostatic involvement	+ +
1	8	"	2d urine clean.....	—
1	10	"	2d urine clean.....	—
4	12	"	prostatic involvement	+ + +

Remarks: The above illustrates the gradual development of a positive reaction.

In anterior urethritis, whether acute or chronic, a positive reaction is not obtained. Cases of urethritis remaining confined to the anterior urethra are, of course, rare. Most authorities agree that in the great majority of cases the posterior urethra is involved. One of Dr. Keyes'[4] cases, however, had had urethritis for ten weeks. The first urine passed was slightly cloudy, the second urine, passed after the prostatic massage, was quite clear and microscopic examination revealed no gonococci. There was a thin mucoid discharge at the meatus, in which gonococci were found, and they were also obtained in culture. Culture made from the urine passed after the prostatic massage was sterile. Here the infection was probably confined to a few glands in the fossa navicularis and there was not enough absorption of toxins to stimulate antibody formation. This case is cited here in order to bring out the point that probably a positive reaction is never found when the disease remains confined to the anterior urethra.

A weakly positive (+) reaction first makes its appearance in the third week of the disease and only then when the posterior urethra is affected. In the ordinary case of acute antero-posterior urethritis without complications running on to cure in six to eight weeks, the most that can be expected is a + reaction. In the absence of complications a strong posi-

tive (+ +) reaction does not make its appearance until the diseases has lasted about eight weeks. A + + or + + + reaction can be obtained as early as the fourth week, when there is some definite complication such as acute prostatitis, arthritis, etc. In fact, a + + + reaction probably is not found when the disease is limited to the genito-urinary tract unless there is some definite implication of the deeper structures.

The fact that a positive reaction is not obtained in the early weeks of the infection should prove an aid in differentiating between a fresh infection and the recurrence of an old, apparently cured, one. This also suggests possible medico-legal application of the test. Case 21, of Dr. Keyes'[4] series, illustrates this point. This was a married man who had infected his wife with gonorrhœa some months previously. Both were treated and finally declared cured, and the blood test made some months later was negative in both. Two weeks later he returned, absolutely denying extra-marital exposure, but with a fresh gonorrhœa two weeks old. Both he and his wife had the blood test made again, and both were negative. Four weeks later he was positive and she was negative, and she remained clinically cured. As Dr. Keyes says, "the development of a positive reaction in him showed the infection to be a fresh one due to extra-marital exposure, in spite of his fervent denials." Dr. Keyes informs us that some six months later the husband finally confessed to the truth of the preceding statement.

Undoubtedly, however, the cases of greatest importance to the clinician, especially when the question of marriage arises, are those of chronic urethritis, prostatitis and seminal vesiculitis following gonorrhœa. Prostatitis is probably the most frequent and important complication. Casper[5] found prostatitis in 85% of cases of chronic urethritis which had lasted over two months. In many such cases we have obtained

a positive complement fixation test when bacteriological methods have left us in doubt as to the presence or absence of the gonococcus. It is in such cases that we think the complement fixation test will prove an addition to bacteriological examination.

II. Chronic Antero-posterior Urethritis

(*a*) *Gonococci present:* In our experience in these cases, a positive reaction is practically constantly found and we do not propose to enter into any detail here. We can only recall one case out of a great many examined in which the complement fixation test failed. This was a case of urethritis, followed in a few days by a multiple gonococcus arthritis. The blood was negative on the thirteenth, twenty-sixth and thirty-sixth days of the disease, and positive on the sixty-first day. By that time, however, the patient had received eight injections of gonococcus vaccine which would have rendered the reaction positive in any case.

(*b*) *Gonococci doubtful:* This group includes five cases in which both smear and cultural examinations were made but in which the findings were inconclusive.

Case I. Gonorrhœa 1 yr. ago. Urine after prostatic massage shows fairly abundant sediment of pus. Smears show a few Gram-negative extracellular cocci. Plates show staphylococci and pseudo-diphtheria bacilli and a few Gram-negative cocci—(gonococci?).

Complement fixation test positive.

Case II. Gonorrhœa fourteen months ago. Urine after prostatic massage shows scanty mucous sediment with a moderate number of pus cells. Smears show Gram-negative and Gram-positive bacilli. Gram-positive cocci and very few Gram-negative cocci. Plates show Gram-negative bacilli, staphylococci and streptococci.

Complement fixation test positive.

Case III. Gonorrhœa five years ago. Urine after prostatic massage shows moderate number of pus cells and a few Gram-negative extracellular cocci. Plates contaminated. Complement fixation test positive.

Case IV. Gonorrhœa three years ago. Urine after prostatic massage shows slight mucous sediment, few pus cells and a few atypical extracellular Gram-negative cocci. Plates sterile. Complement fixation test negative.

Case V. Gonorrhœa three years ago. Urine after prostatic massage shows moderate number of pus cells. Smears show many Gram-positive cocci and a few Gram-negative extra- and intracellular diplococci. No Gram-negative cocci. Complement fixation test positive.

(*c*) *Gonococci negative—both in smear and culture.* Nine cases giving a history of gonococcus infection from nine months to fifteen years previously were negative by the complement fixation test thus agreeing with the bacteriological examination.

Two cases gave a positive complement fixation test.

Case I. Gonorrhœa one year ago. Urine after prostatic massage shows a moderate number of pus cells. Smear shows Gram-positive cocci. No Gram-negative cocci. Plates show staphylococci and streptococci. No Gram-negative cocci.

Case II. Gonorrhœa three months ago. Urine after prostatic massage shows few pus cells. Smears show Gram-positive cocci and Gram-negative bacilli. Plates show streptococci and Gram-negative bacilli. In this case the positive complement fixation test was very possibly a fading reaction.

(*d*) *Gonococci negative in smear only—cultural examination not made.* Six cases, giving a history of gonococcus infection from seven months to five years previously were also negative by the complement fixation test. One case, giving

a history of gonococcus infection two years previously, was positive by the complement fixation test.

(*e*) *Cases in which gonococci were not searched for.* These cases all had symptoms of chronic urethritis believed to be post-gonorrhœal. The duration of the urethritis varied from two to fifteen years. Thirty-one cases were examined, of which ten or 32.2% gave a positive reaction.

The cases included in groups *b, c, d* and *e,* were all regarded clinically as post-gonorrhœal. If now we group all these cases together, we find that out of fifty-four cases examined a positive result was obtained in seventeen or 31.4%. These figures closely correspond with those reported by Keyes in post-gonorrhœal urethritis—in twenty-six cases carefully examined by smear and culture gonococci were found in eight or 30.7%. In a number of our cases, however, the result of smear and cultural examinations was suspicious, but inconclusive, as cited in group *b,* whereas the complement fixation test was definitely positive or negative. Herein, in our opinion, lies one great advantage of the complement fixation test.

Verumontanum disease—Gonococci not found. Twenty-two cases of disease of the verumontanum have been examined. Of these, twenty-one admitted gonorrhœa from one to ten years previously. Four of the twenty-one gave a positive reaction and seventeen a negative reaction. One case, cited in our previous paper, absolutely denied gonorrhœa, but had given a positive result on two separate occasions. After six months' treatment he was found to be negative.

IV. Chronic Prostatitis

(*a*) *Gonococci present:* Three cases were examined, all of which gave a positive complement fixation test.

(*b*) Cases giving a definite history of gonorrhœa—gonococci not searched for.

Date of last gonorrhœa	No. of cases	Pos.	Neg.
5 weeks to 1 yr. ago	31	20	11
2 yrs. ago	19	9	10
3 yrs. ago	12	5	7
4 yrs. ago	5	2	3
5 yrs. ago	7	0	7
6 yrs. ago	3	2	1
7 yrs. ago	5	2	3
8 yrs. ago	2	1	1
10 yrs. ago	3	1	2
12 yrs. ago	6	3	3
14 yrs. ago	1	0	1
20 yrs. ago	3	1	2
30 yrs. ago	1	0	1
(c) Gonorrhœal history doubtful	9	2	7
(d) Gonorrhœa denied	2	0	2

In group *b* we have a total of ninety-eight cases of chronic prostatitis in which a definite gonorrhœal history was obtained. Of these, forty-six, or 46.9% gave a positive reaction. In sixty-two of these ninety-eight cases there was a history of gonorrhœal infection within three years, and thirty-four, or 54.8%, of these gave a positive result. In our previous paper we reported twenty-five cases of chronic prostatitis, seventeen of which, or 68%, gave a positive result. In seventeen of these twenty-five cases there was a history of gonorrhœal infection within three years, and thirteen, or 76.4%, gave a positive reaction.

We have thus examined 123 cases of chronic prostatitis, giving a clear gonorrhœal history. Of these, sixty-three, or 51.2%, gave a positive result. In seventy-nine of the cases there was a history of gonorrhœal infection within three years and of these forty-seven, or 59.4%, gave a positive result.

It will be noted that we have obtained positive results in cases where the last gonorrhœal infection was stated to be anywhere from six to twenty years ago. We, of course, do not vouch for the accuracy of the patients' statements in that regard. Opinions vary greatly as to the length of time the gonococcus may persist in the genito-urinary organs of the male and female. We feel that a patient giving a positive complement fixation test should be looked upon as still har-

boring gonococci, irrespective of the date of the last gonorrhœal infection.

Casper,[5] as already stated, has shown that prostatitis occurs in 85% of cases of chronic urethritis. Our results show that the gonococcus may lurk in the prostate for a long time after all other evidence of the disease has disappeared. Therefore, all cases of prostatitis in patients giving a history of preceding gonococcus infection however remote should be carefully examined bacteriologically and serologically before they can be considered free from gonococci.

Seminal Vesiculitis

Date of last gonorrhœa	No. of cases	Pos.	Neg.
6 months ago	1	0	1
3 years ago	3	1	2

Clinically Cured Cases

In this group we have included only such cases as have been looked upon as clinically cured for at least three months. This was done so as to avoid the possibility of including cases which actually were cured but might still present a fading reaction.

We have examined in all 165 cases of which twenty-two, or 13.2%, gave a positive reaction. These figures corresponded closely with those reported by Schmidt[6] at a recent meeting of the American Urological Society. Out of forty-two cases examined he obtained a positive result in five, or 11.9%. Keyes[4] estimates about 4% of clinical error in cases apparently cured, basing this statement on the results of laboratory investigation of eighty-six patients clinically cured, of urethral gonorrhœa. Thirty-six of his cases were examined by the complement fixation test, and seventy-seven by smear and culture.

In our previous paper we reported 43% of positive results in cases of this group. Our first series contained all cases

examined from the very beginning of the investigation, before we had any definite idea of the possibilities of the test and cases were classed as clinically cured which more rigid examination would probably have excluded from that group. The cases here reported have all been very thoroughly examined before being classed as clinically cured and we think that 13.2% represents fairly accurately the clinical error in such cases.

Women

The diagnosis of gonococcus infection in women is well known to be very difficult and uncertain. The symptoms of the infection are generally not pronounced, consisting often only in slight burning micturition and increase of vaginal discharge. An alteration in the discharge may be the only history of infection—from being mucoid and unirritating, it may become purulent and irritating. Frequently the first symptoms to be obtained may be referable to tubal disease, a cervical catarrh or a vulvo-vaginal abscess, so insidious is the invasion of the disease.

Bacteriological methods of diagnosis are not of any great assistance in the diagnosis of gonococcus infection in women, except in the acute forms which are relatively rare. In subacute and chronic forms, gonococci are generally very scanty. They are to be found more particularly in the discharge from the urethra and cervix. However, the great number and variety of other organisms present in such discharges renders the absolute demonstration of the gonococcus exceedingly difficult both in smear and culture. Very often both clinical and bacteriological examinations leave one in doubt; and the diagnosis of chronic gonococcus infection must be only a probable one. Hence we feel that in women the complement fixation test should prove a distinct addition to our means of diagnosing chronic gonococcus infection.

Extent of Involvement Necessary to Obtain a Positive Reaction

It will be remembered that in discussing the question of gonococcus infection in the male, it was stated that a positive reaction was not to be obtained if the disease remained confined to the anterior urethra. There had to be at least some involvement of the posterior urethra in order to obtain a positive reaction. In gonococcus infection in the female, the organs chiefly involved are the urethra and Skene's glands, Bartholin's glands, the cervix, the uterine tubes, ovaries and peritoneum. The vagina very commonly escapes, especially in the adult, probably on account of the fact that it contains no glands within which the gonococcus can lurk; it is lined with pavement epithelium and the gonococcus is known to have a predilection for surfaces lined with columnar epithelium; and finally, the vagina is bathed in an acid secretion which distinctly inhibits the growth of the gonococcus. In children the vaginal mucosa is much more likely to be infected, as in the young the pavement epithelium is softer and more like columnar epithelium. Hence the frequency of gonococcus vulvo-vaginitis in children.

The endometrium also frequently escapes. According to Kelly,[7] an infection of the cervix, traveling upward, often creates no recognizable symptoms as it traverses the uterus, until the uterine tubes are affected. He further says that the uterine mucosa is often perfectly normal even where there is a pyosalpinx on one or both sides.

We have obtained positive reactions in cases of peritonitis, in tubo-ovarian disease and in disease of the cervix.

We have also obtained a positive reaction in two cases of vulvo-vaginal abscess, but in the absence of abscess formation, we doubt if a positive reaction will be obtained unless there is some infection of the cervix. In other words, we think a negative reaction will probably be obtained if the disease is limited to the urethra, Skene's glands and Bartholin's glands. Such

cases are doubtless rare, as in the great majority of cases of chronic gonorrhœa in the female the cervix is involved. Still we feel that the possibility deserves mention here. In gonococcus infection in very young children, the vulva, urethra and vagina are chiefly affected; only rarely are the cervix, corpus uteri and tubes involved. We have examined ten cases of vulvo-vaginitis in children under five years of age. In all, the gonococcus was demonstrated in smear and culture. In all the complement fixation test was negative. This tends to support our opinion that a positive complement fixation will not be obtained unless there is involvement of the cervix.

The important role which the gonococcus plays in the production of pelvic disease in woman scarcely needs mention. Destructive inflammation of the tubes and ovaries, with peritonitis, is common, as is also gonococcus infection of the bladder with secondary ascending infection of the ureters and kidneys. The Committee of Seven of the American Medical Association asserted that 80% of the deaths from female pelvic disease are due to gonococcus infection. It is said that 90% of sterile women are married to men who have suffered from gonorrhœa either previous to, or during, married life. Many of these cases of sterility are, of course, directly due to the man, by reason of impotence, azoöspermia, etc., but a consideration of the whole subject would be out of place in this paper.

Finally, on every general maternity service, cases of gonorrhœal ophthalmia occur from time to time. Statistics show that even with the use of silver nitrate in the eyes, this disease occurs as often as once in every 200 cases. Apart from the possible serious effects upon the eyes of the child itself, there is always great danger of the infection spreading to other infants and nurses. Therefore, on account of the unreliability of the smear and cultural methods of diagnosis of subacute and chronic gonococcus infections in women, we think that the complement fixation test should find a distinct place in gynæcological conditions and that in general ma-

ternity services it will be of use in the prevention of gonorrhœal ophthalmia.

We have not applied the test in diseases of the genito-urinary tract in the female as extensively as we have in the male. This was mainly on account of the fact that our principal object was to study the possibilities and limitations of the test. This could be done much more satisfactorily in the male on account of the fact that the course and development of gonococcus infection is much more readily studied in the male. Furthermore, the complement fixation test could be more thoroughly controlled by bacteriological examination in the male than in the female.

The statistics which follow give, however, a fair idea of the field of usefulness of the complement fixation test in gynæcological conditions.

Clinical diagnosis	Pos.	Neg.
Urethritis and endocervicitis		
(a) gonococci present	9	0
(b) gonococci not found	8	3
Gonorrhœa clinically cured	1	4
Chronic gonorrhœa; gonococci not found	2	0
Gonorrhœal vulvo-vaginitis; girls under 5 yrs.; gonococci present	0	10
Salpingo-oöphoritis	9	3
Pyelitis clinically considered gonorrhœal	2	0
Vulvo-vaginal abscess; gonorrhœal	2	0
Pelvic peritonitis	3	1
Pregnancy; gonococci present	1	0
Pregnancy; gonococci not found	14	40
Miscellaneous cases from the clinic; lacerations, displacements, etc.	13	50
Pyosalpinx	3	4
Pelvic abscess	0	2

In one case clinically diagnosed as pyosalpinx, and giving a negative complement fixation test, the condition found at operation was a cystic ovary with normal tubes.

One case diagnosed as pelvic abscess, and giving a negative complement fixation test, was found at operation to be a tubo-ovarian abscess from which the colon bacillus was obtained in pure culture.

Any special comment on these cases does not seem called for. The only point we wish to bring out is as to the relative frequency of gonococcus infection in women as shown by the complement fixation test. The number of cases examined is, of course, very small for statistical purposes, but as the cases are absolutely unselected—simply consecutive ones taken as they appeared at the clinic—the figures are at least suggestive. Out of 184 cases examined, a positive result was obtained in sixty-seven, or 36.4%.

These figures may seem somewhat high, but it must be remembered that all these cases were taken from a public gynæcological clinic or maternity hospital. In private practice one would certainly not expect such a high percentage of positive results. Statistics vary greatly as to the prevalence of gonococcus infection in women, the variation depending largely on the class of patients examined. Huber[8] among 573 prostitutes, sick and well, found gonorrhœa in 59.6%. Prowe,[9] in 407 sick prostitutes, found gonorrhœa in 78.9%. Ivens[10] found gonorrhœa in 14% of 1052 consecutive gynæcological out-patients, and in 24% of 157 in-patients, mainly all operation cases. Nearly all of these cases were poor, respectable married women. Sänger and Schwartz[11] found gonorrhœa in 12% of all their patients, public and private. Erb[12] found 4.5% of all married women affected. The Committee of Seven appointed by the Society of Prophylaxis of Venereal Diseases in New York to investigate gonorrhœa in women reported that 30% of all married women treated by gynæcologists in private practice had gonorrhœa. The difficulty of finding the organisms in chronic cases is another factor which accounts for the great diversity of opinion as to the prevalence of gonococcus infection in women. Statistics will vary according to the skill and thoroughness of the bacteriologist. We think that future statistics based on the complement fixation test will not show such variation, as in this method the personal factor of the examiner does not play such a part.

Summary

I. A positive reaction denotes the presence or recent activity in the body of a focus of living gonococci.

II. A negative reaction does not exclude gonococcus infection but, for the reasons stated, should be accorded considerable importance.

III. A strong positive reaction is not to be expected earlier than about the fourth week, and then only in very acute cases with some complication.

IV. A positive reaction is not obtained if the disease is limited to the anterior urethra.

V. A positive reaction does not entirely disappear until seven or eight weeks after cure.

VI. In other words, if a strong positive reaction is obtained seven or eight weeks after apparent clinical cure, the patient should be looked upon as still harboring gonococci.

VII. In chronic cases, isolation of the gonococcus in culture is the only absolute, bacteriological proof of gonococcus infection.

VIII. The technique of a complement fixation test is simpler than that of isolation of the gonococcus in culture and the possibilities of error are less.

IX. In cases regarded clinically as post-gonorrhœal, a positive reaction is obtained in 31.4%.

X. In 62 cases of chronic prostatitis giving a history of gonococcus infection within three years, a positive reaction was obtained in 54.8%.

XI. In 165 cases looked upon as clinically cured for at least three months, a positive reaction was obtained in 13.2%.

XII. In women a positive reaction is probably not obtained unless there is at least some involvement of the cervix.

XIII. On account of the unreliability of the bacteriological diagnosis of gonococcus infection in women, the complement fixation test should prove of special usefulness in gynæcological conditions.

XIV. Our results show that 36.4% of patients in public gynæcological clinics and maternity hospitals are suffering from gonococcus infection.

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DISCUSSION

DR. G. K. SWINBURNE, of New York: Dr. Schwartz said that one case of gonorrhœal joints gave a positive reaction only after sixty days, and also after eight injections with the bacterins. Three cases that he examined for me had been recently on bacterins and gave a negative reaction. One was a man whose blood had been positive previously. He was a candidate for matrimony, and just the month before he sent his blood for the test he had been given twelve injections of 500 millions each of gonococci, and yet his blood was negative. Another case was a man who had within two months been given bacterins. I did not treat this case. He sent his blood to me for examination. He had been given as high as two billions, and that was just two months from the time his blood was sent. The other case had a longer period of time before the blood was negative. That might readily have been so, because six months had elapsed.

In making up the antigen I think it is important to keep up the strains. A great many of these cases where the tests are negative, are negative because now we are only working with ten strains—Dr. Schwartz said eleven strains. There are twelve known strains, and it is a question whether more may not be found. One case that Dr. Schwartz examined for me with six strains gave a negative result, and with twelve strains a positive. So that with only ten strains we might say there is a 20% proportion of failures.

One case that I had last winter is of interest. A young woman came to me with her left knee joint painful, swollen and stiff, with a history of syphilis and gonorrhœa three years before. Some doctor had given her an intramuscular injection of salvarsan previously. I had a Noguchi test made and a gonorrhœal test. The gonorrhœal test was negative, and the Noguchi positive, and the knee cleared up in a few weeks on mixed treatment.

DR. SCHWARTZ: I think the question of the vaccine which Dr. Swinburne spoke about has got to be worked out more. We have had several cases where we did not get any reaction with smaller doses of vaccine than Dr. Swinburne speaks about.

DR. O'NEIL: In regard to obtaining a reaction early in the disease, in one or two cases we have gotten it when there was only an anterior infection. We got one on the eleventh day, which I believe is contrary to the experience of everyone else. Whether this was an error in technique, I cannot say. It was a very acute case, and possibly the posterior urethra may have been somewhat infected, although I have it listed as an anterior infection only.

A LARGE SILENT VESICAL CALCULUS REMOVED BY LITHOLOPAXY AT THE OFFICE

By H. A. FOWLER, M. D., of Washington, D. C.

WITH stone in the bladder we are accustomed to associate the three cardinal symptoms of disturbance in urination—frequency, urgency and tenesmus—pain and hæmaturia. It is rare that all these symptoms are wanting in any given case of vesical calculus. In cases of prostatic hypertrophy associated with retention and complicated by stone in the bladder, the residual urine acts as a cushion, preventing the bladder walls from contracting down on the calculus. The usual symptoms of stone may also be masked by those symptoms referable to the prostate. In certain cases of this kind the calculus may not cause any of the classical symptoms and its presence even may not be suspected until revealed by the cystoscope.

It occasionally happens that one sees a patient who has tolerated a stone in the bladder for years although suffering intermittent attacks of cystitis the true nature of which was not recognized. I operated upon one such patient, removing two very large calculi several inches in circumference. This young man was attending a school in Washington preparing for Annapolis. He had suffered for years with recurrent, intermittent attacks of cystitis, but during the interval between the attacks he was fairly comfortable. This young man was leading an active life and preparing for a naval career while carrying about in his bladder two stones. The symptoms were not severe enough to interfere with his active life, and only when the stones had attained a very large size and had done irreparable damage did they produce symptoms severe enough to attract serious attention and make their removal imperative. In these days it is rather unusual to see a patient with a vesical calculus who has escaped for so long a time the lithotrite or the knife.

It is still more unusual to see a patient, a young man without retention, who is carrying about in his bladder a large stone which gives absolutely no symptoms, and which is discovered only accidentally during a routine examination. Such a case has been under observation recently. It seems sufficiently rare and interesting to be worth reporting. The history follows:

J. B. M., aged 46 years, was referred to me by Dr. Lawson. He stated that he did not have an ache or pain, that there was no disturbance whatever in his urinary apparatus as far as he was aware, and that he never felt better in his life. Six weeks before he had a typical attack of renal colic, followed by the passage of a calculus *per urethram*. During this attack he had suffered intensely. Since the attack he had been perfectly well and free from all urinary disturbance. He came for a general examination to find out if there was any likelihood of another attack similar to the one six weeks before, and if so, if something could not be done to prevent it.

The following history was obtained: Seven years ago he passed two small stones. He was taken with a sudden, severe pain in the right loin. He was nauseated, but did not vomit. Three or four hours later he passed the two stones. Since this attack he has noticed occasionally some frequency of urination, pain along the urethra, and has been, as he expressed it, subject to cold. By this he meant that exposure to cold often precipitated an attack of frequent urination.

Five or six months ago he was seized with a sudden, severe pain in the right loin which passed off immediately. The pain was so severe as to almost throw him to the floor. There was no hæmaturia noticed following the attack, and no disturbance in urination. It was four months later that he had the last attack of kidney colic, followed by the passage of a stone the size of a Lima bean. Since this attack, six weeks ago, he has felt normal in every way, and states that he has not had to be so careful about exposure to cold as heretofore.

Examination. The patient appears to be in perfect health. He is active, vivacious, and not greatly concerned about himself. He seeks an examination merely as a matter of precaution.

External genitalia are normal. The urine is very light and clear like water, free from shreds, acid, specific gravity 1018. There is a trace of albumin by both the heat and nitric acid tests. A centrifuged specimen shows a few red cells, a few leucocytes, and cylindroids. The prostate is normal and the examination is not painful. Two days the findings were similar; the urine was perfectly clear. It was then suggested that it would be interesting to see what changes, if any, had been produced in the ureteral opening by the passage of the calculi. To this suggestion he readily assented. It was at the third visit that the urine first showed macroscopic changes suggesting some trouble in the urinary apparatus. It was slightly turbid, which fact was due chiefly to pus and some blood. There were, however, no symptoms.

On introducing a silk catheter we were amazed to feel the tip impinge upon a hard object readily recognized as a stone. On attempting to withdraw the catheter some difficulty was experienced as the stone was drawn down toward the vesical orifice and threatened to prevent the withdrawal of the catheter. The cystoscope showed a large, round, single, freely movable, dark-brown, mulberry calculus lying over the edge of the trigone and behind the interureteral bar, covering the right ureteral orifice. The bladder mucosa was slightly reddened over the base but no general cystitis was present. Bladder capacity large. Litholopaxy at the office was proposed and accepted. Under cocaine a large amount of débris of pure oxalate of lime was removed. The calculus was very hard and crushing therefore difficult and tedious. The bladder seemed wonderfully insensitive, so the patient suffered little. The lithotrite was introduced twice and about half the stone removed. After the *séance* he boarded a street car and rode to his home in Kensington, a distance of seven miles. There was no febrile reaction following this first *séance,* but he remained in bed two days on account of the irritation produced by the passage of some fragments left in the bladder.

Two weeks later he returned for the removal of the remainder of the stone. At this time there was no disturbance whatever in urination. On attempting to introduce a silk catheter for the purpose of washing out the bladder and depositing cocaine, it met with an impassable obstruction at the vesical outlet. The fragment of stone still remaining in the bladder had become wedged down into the orifice of the prostatic urethra, effectually closing it to the passage of a flexible instrument. A silver catheter was then used, the tip of the catheter was passed under the stone in such a way as to lift it up into the bladder, and free the orifice. A silk catheter was then passed with ease. During this manipulation a slight trauma was produced as evidenced by the appearance of a little blood at the meatus. It was therefore impossible to cocainize the urethra for fear of rapid absorption. Only a

small amount of cocaine was instilled into the bladder through the catheter. However, with this very meager amount of anæsthesia, we proceeded with the crushing and succeeded in removing the remainder of the stone without causing the patient very much pain. It must be said, however, that this man was an ideal patient for this operation.

There was no rise in temperature following either *séance*, and except for the usual irritation incident to any urethral instrumentation, the patient was quite comfortable on the following day. The stone in this case was a pure oxalate of lime of the mulberry type, and about the size of an English walnut, very hard, and required considerable force to crush it. The operation was necessarily somewhat prolonged on account of the hardness of the stone and the fact that we were working with a local anæsthetic. However, the patient expressed himself as greatly pleased and surprised at the absence of marked pain and suffering. A subsequent cystoscopy, two weeks later, proved that the stone had been completely removed. At this time the urine was clear and free from infection. The right ureteral orifice was now seen to be very irregular and jagged, the result of trauma from the recent passage of a large calculus.

There are several interesting points in connection with this case. Perhaps the most striking fact was the complete absence of symptoms with such a large rough calculus in the bladder. The finding of this stone was totally unexpected; its presence was not suspected; and it was discovered only in the course of a routine examination. This absence of symptoms is explained in part by the absence of infection. One would think, however, that the trauma produced would give rise to marked irritation. That it did not do so can be explained only by assuming that in this case the bladder was markedly insensitive. And this is borne out by the freedom from suffering enjoyed during a somewhat prolonged operation under almost no anæsthetic during the second *séance*. This patient has been under observation since the operation. The urine

has remained free from pus and infection. An X-ray of the kidneys and ureters was negative.

This case is of further interest as it illustrates the value of litholopaxy as an office operation in certain cases. In certain selected cases this operation can be carried out in one's office with entire safety and satisfaction. I have operated in this way fifteen times upon nine patients. In three patients two crushings each were necessary for the complete removal of the calculus. In the remainder the stone was removed in one *séance*. The size of the stones varied from that of a pea to a relatively large calculus such as the specimen here presented which was the largest of the series. In one case three stones were present, each about the size of a marble. In no case were there any post-operative complications, and the patients expressed themselves as entirely satisfied and pleased to have the operation done in the office.

It has been our invariable rule to follow the operation with a cystoscopy to make sure that no fragments remained in the bladder. In the majority of cases this cystoscopic examination was made immediately following the litholopaxy and before the patient left the table. The hæmorrhage was not sufficient to interfere with a perfectly satisfactory cystoscopy, performed in many cases with an ordinary Nitze examining cystoscope. I wish to emphasize this point particularly as it illustrates very well the fact that the trauma to the bladder and posterior urethra was practically *nil*. And no one would think, nowadays, of doing a litholopaxy without controlling his work with the cystoscope.

It will be understood, of course, that I do not believe litholopaxy can or should be done in the office in every case where litholopaxy is the operation of choice. But I do believe that in selected cases this operation can be done in one's office with entire safety and satisfaction. This procedure is particularly applicable to that class of cases in which there is no obstruction (intravesical prostatic hypertrophy), the calculus is relatively small, the bladder capacity is ample—at least 150

c. c.—and the bladder tolerance good. I have always used cocaine in 4% solution, and find it perfectly satisfactory as a local anæsthetic in these cases. This solution is sterilized by boiling in a test tube just before using. There is one very important point in the use of cocaine which should not be neglected: never use cocaine in the urethra and bladder after the slightest trauma has been produced. If this precaution is taken one will never see the symptoms of cocaine poisoning which seem to be so much feared by some. In working under a local anæsthetic one is bound to be more gentle and careful than when using a general anæsthetic. There is therefore less likelihood of producing trauma in the manipulations of the lithotrite. The introduction of the lithotrite and the evacuating tubes is no more difficult than the introduction of the steel sound and the cystoscope. And with care in their use in these simple cases there should be no trauma and consequently no post-operative reaction.

A CASE OF CALCULOUS PYONEPHROSIS IN A CONGENITALLY MISPLACED KIDNEY

By Horace Binney, M. D., of Boston

WHILE the frequency with which congenital misplacement or dystopia of the kidney is first discovered at autopsies in aged subjects dying from various causes points to the anatomical rather than surgical interest of this condition, nevertheless it seems to the writer that a case of secondary disease of such a kidney leading to rather urgent symptoms requiring surgical attack, is worth recording.

I am indebted to Dr. Paul Thorndike for the privilege of having studied and cystoscoped the patient, of having assisted him in the operation at which the condition was discovered, and of reporting the case here.

The patient, a young man of the laboring class, had been healthy up to his twenty-first year, or the early part of 1899.

He then had an attack of hæmaturia, without pain, lasting three or four days. Some time after this the Spanish War broke out, when he enlisted and served through that year in South Carolina, during which time he gained twenty-two pounds. Two years later another attack occurred, lasting one week. Soon after this he contracted gonorrhœa, from which he recovered without incident. In the next year he had three more severe attacks of bleeding in which he felt pain in the lower left back, at the last one passing several small clots. Two weeks after this (February, 1903) he entered the Boston City Hospital, in the service of Dr. Post. Abdominal and rectal examinations were negative. The urine revealed nothing beyond a few normal red cells and leucocytes, but cystoscopy showed a much injected bladder mucosa with an irregular prostate, near the right side of which a dark mass was made out and thought to be a tumor of the bladder. This was seen again at a second cystoscopy, and operation decided on. Suprapubic cystotomy was performed, the bladder wall found injected and " everywhere studded with pearly gray granules, suggesting miliary tubercles." (I quote from the record.) " No tumor or darkened area as seen with the cystoscope " found. Some of the granules were removed with the curette for pathological examination, the mucosa painted with iodine and the bladder closed with drainage by catheter. The patient made an excellent recovery, had no more bleeding and was discharged on the seventeenth day. The pathological examination of the curettings failed to show tuberculosis.

The patient was then well for nine years. In March, 1911, he entered the hospital again in Dr. Thorndike's service, with the history of having been weak and run down for three months. No blood was noticed but the urine contained a heavy sediment on standing. He had felt considerable constant pain in the region of the bladder and had lost about twenty pounds. There was, however, no frequency or pain on micturition. Examination showed a tumor in the left side

of the abdomen, of the size of a grape fruit, its upper part being about on a level with the umbilicus. It was felt bimanually through the loin, was tender and not movable, and was apparently situated entirely above the pelvic brim. At no time was there any rise in temperature.

On March 25, 1911, he was cystoscoped by me, the bladder mucosa appearing normal with a slight trabeculation on the sides and posteriorly. In the region of the suprapubic scar a slight pouch was noticed. The right ureter was normal with a normal efflux. No efflux was seen from the left ureter and an ureteral catheter failed to pass. Three days later the patient was cystoscoped again. Indigo carmine was injected and appeared promptly from the right side, but was much delayed from the left ureter, the efflux from the latter being very faint. A No. 5 catheter was passed for twenty centimeters up the left ureter when it met a firm obstruction, and a few drops only of purulent urine escaped from it.

The diagnosis then made was: normal right kidney, left pyonephrosis or abscess connecting with the left ureter. An X-ray was taken, showing nothing definite, but the region of the left ilio-sacral synchondrosis was less clear than the right. It is fair to say that the hospital X-ray apparatus was then not working satisfactorily. The final diagnosis then lay between an abscess arising from a diseased condition of the bone or soft parts in the lumbar region and connecting with the ureter, or a pyonephrosis in a kidney situated lower than normal. Congenital displacement was not thought of.

Operation. On April 1, 1911, the abdomen was opened in the left lower quadrant, the mass exposed and found adherent to the surrounding viscera. It was walled off and aspirated, pus escaping. On incising it a pint of thick flocculent pus was evacuated, the cavity was emptied, a drainage tube fastened in, and some gauze placed about the tube. The origin of the abscess was not made out. One month later the patient was discharged with a small sinus.

He soon was able to return to work, but the sinus continued discharging and he returned to the Out-Patient Department, where he was under the care of Dr. Cheever, who noted that the whole left iliac and umbilical region was flat on percussion and slightly tender; there was no tenderness in the kidney region. Cystoscopy by him in May, 1911, showed chronic cystitis. The left ureter could be catheterized for only 2 c.m. The phenolsulphonephthalein test showed a normal function of the right kidney (8 min.) and a much delayed appearance of the dye from the left ureter, the urine being obtained by a bladder catheter, and the color only faint at the end of one hour. Examination of the sediment then showed pus, blood and epithelial cells, no casts or crystals. A bacteriologic examination showed streptococcus pyogenes only.

During 1911 the patient's condition remained unchanged, his general health being good, but the sinus remained unhealed and the urine did not clear up. Accordingly, in February of this year, he decided to have the kidney removed if necessary, and re-entered the hospital, with a small sinus discharging pus in the left linea semi-lunaris and opposite the navel. It was suggested that an attempt be made to obtain a collargol picture of the kidney and ureter, but as the patient was strongly opposed to further cystoscopies, and as the last endeavor to catheterize the ureter had failed, this was abandoned.

February 5, 1912. Operation by Dr. Thorndike. Through a lumbar incision, exploration of the normal kidney site and dissection of the whole lumbar retroperitoneal space failed to discover any signs of kidney. A probe passed into the sinus was felt to enter the pelvis, and with the incision prolonged downward to the middle of Poupart's ligament, the pelvis was exposed, and a large mass found in the left side of the pelvic cavity wholly below the pelvic brim. In freeing the peritoneum, this was torn but easily repaired. The mass was dissected free, but ruptured in the process, thick pus escaping. The finger entered a dilated kidney pelvis wherein several

stones were felt. The ureter was found and ligated just below the mass. Owing to dense surrounding adhesions no definite pedicle was made out, the vessels being small. These were tied and cut as adhesions were encountered. After removal of the mass the sinus was freed and excised by a transverse incision joining the inguinal wound. Drains were placed in loin and pelvis. Four days later the urine was of normal color. Much discharge from wound at first, soon diminishing. March 12 the patient left the hospital with a small discharging sinus in the lower part of the wound.

The specimen consisted of a much lacerated pyonephrotic sac, made up largely of fat and fibrous tissue, with but little renal parenchyma remaining. A moderate sized branched calculus was broken during the removal.

The patient was seen May 1st in excellent health. Sinus healed. The scar is firm and causes no discomfort. Urine normal. (Slightly acid; 1018; no albumin; sediment, slight; few squamous round cells and leucocytes; rare fine granular casts.)

The many recent contributions to the literature of congenital renal misplacement testify to the increasing knowledge on this subject, and the greater frequency with the condition is recognized clinically. The articles by Hochenegg[1], Kehrer[2], Sträter[3], and Dorland[4] have covered the ground very thoroughly, and they mention four cases similar to the one here reported.

There are, however, two points, in connection with this case, of special interest. First, as to diagnosis, it is evident that ureteral catheterization alone will not clear up the question. The lumen of the catheter may become obstructed by pus, so that the steady flow of urine, which, as suggested by Müllerheim[5], should demonstrate the low position of the renal pelvis, will not be obtained. Moreover, we may be deceived as to the length of the ureter, for in the case here reported, the catheter, at the first cystoscopy, passed for twenty centimeters into the left ureter, evidently having curled up in the

renal pelvis, as the ureter was found at operation to be not over ten centimeters in length.

It is, therefore, clear that in a case where there are no signs present of an elastic mass with pulsating vessels, and of a shape suggesting the kidney, a certain diagnosis cannot be made without a collargol injection or at least the styletted catheter and the X-ray.

The necessity for an exact diagnosis becomes obvious when we consider the question of treatment—in particular, the method of approach—which is the second point to which I would refer. There are, of course, two methods of approach, the abdominal and the lumbar. The abdominal route is strongly advocated by Sträter on the ground of affording a better view of, and easier access to, the renal vessels. It is certainly the method of election in simple uninfected cases, and many such kidneys have been successfully removed by this route.

On the other hand, since the tumor is always retroperitoneal, I believe that pyonephrotic misplacement should be approached, as in this case, by the extraperitoneal lumbar incision. As the sac is likely to be ruptured in removal, this route avoids the danger of peritoneal infection, and lessens the possibility of hernia in the scar, for free drainage may be necessary. The longer incision and deeper dissection are, I believe, outweighed by the greater safety of the lumbar method.

It may be of interest to note, in addition, that but few cases of congenital misplacement, demonstrated by radiography, have as yet been reported. Müllerheim demonstrated one by means of X-rays with the styletted catheter.

In Casper's Text Book of Cystoscopy,[6] 2d Edition, there is an X-ray picture of another case, in which the stylet shadow ends in the median line in front of the promontory of the sacrum, where the kidney lay.

Desnos[7] reports a case where the radiograph showed a shadow on the course of the left ureter just above the pelvic

brim. The outline of the tumor present could not be distinctly made out, and the ureteral catheter was obstructed at a point seven centimeters above the bladder. His diagnosis was " probable ureteral calculus." On operation he failed to find a kidney in the normal site, finally discovering it in the left iliac fossa. He removed the stone by pyelotomy, leaving the kidney *in situ*.

This experience of Desnos and the case reported in this paper demonstrate that ureteral catheterization and X-rays alone may fail to reveal a congenitally misplaced kidney where calculi or pyonephrosis have developed. Pyelography, therefore, should always be attempted in atypical cases of stone or renal or ureteral suppuration in order that we may arrive at a complete and exact diagnosis before operation is undertaken. Needless to say, the possibility of a misplaced kidney should always be borne in mind in such cases.

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UNILATERAL KIDNEY CALCULUS COMPLICATED BY URETERO-VESICAL CYST OF THE OPPOSITE SIDE

By Benjamin S. Barringer, M. D., of New York City

URETERO-VESICAL cyst is a dilatation of the vesical portion of a ureter. This dilatation is dependent upon a narrowing or stricture of the ureteral opening. It is probable that this strictured condition is always congenital, notwithstanding that such a condition has been attributed to the passage of calculi or blood clots through a ureter. The fact that they are frequently bilateral and that in two cases recently reported a double ureter accompanied the uretero-vesical cyst emphasizes the probability of congenital origin of the stricture.

I have seen two cases of uretero-vesical cysts, one bilateral and the other, that which I wish to report, unilateral. The fully developed cyst is readily identified by the cystoscope. The cyst dilates with each efflux of urine, and the mouth of the cyst, the ureter orifice, is so small as to take only the smallest ureter catheter. When these cysts are not at all advanced and the merest dilatation occurs at each time urine is excreted, the diagnosis is difficult.

Operation is indicated in all of these cases of uretero-vesical cyst because the cyst is evidence of renal retention and causes secondarily hydronephrosis or pyonephrosis and reduced kidney function. The simplest operative procedure and, as far as my experience goes in one case, the best, is simple incision of the ureteral orifice. This is easily done with a sharp knife through an open tube. I cannot see any reason, unless the cyst be extremely large or the orifice inaccessible to the cystoscope, for a suprapubic operation or for suturing each edge of the incised ureteral orifice.

Mrs. S., 55 years of age, gave a history of attacks of left kidney pain and kidney colic. The attacks for two years past

PLATE VII. — Presented by Dr. Benjamin S. Barringer

Fig. 1

Radiograph of kidney stone

have incapacitated her for both work and pleasure. When first seen in April, 1910, her left ureter was catheterized with a 7 F. catheter and while nothing abnormal was recognized about her right ureter orifice it could not be catheterized, however, and the urine from the right kidney was collected from a bladder catheter. I attributed the failure to catheterize the right ureter to myself rather than to any abnormality of the ureter orifice. The analysis of the collected urines was:

RIGHT URINE	LEFT URINE
Quantity 25 c. c.	25 c. c.
Urea 16½ gm. per liter.	11½ gm. per liter.
Urea Vol. 0.427 gms.	0.287 gms.
Microscopical	
Red blood cells. Present (traumatic).	Rare.
Pus, none.	Much
Epithelium, rare squamous.	Many cells probably coming from kid. pelvis.
Indigo-carmine test	
Blue in 15 minutes.	Blue in 25 minutes, never as
Marked blue in 25 minutes.	marked as on right.

On a radiograph (Fig. 1) a very large calculus was shown in the left kidney. I saw the patient again in October, 1911, at which time I also failed to catheterize the right ureter even when using a very small, No. 4 F., olivary catheter. On close observation of the right ureter orifice (Fig. 2) during urinary excretion I noticed a considerable cystic dilatation and diagnosed the condition as an uretero-vesical cyst.

The analysis of the urines collected at that time was as follows:

RIGHT	LEFT
Vol. 4 c. c.	9½ c. c.
Urea 5½ grams to liter.	4 gms. to liter.
Urea vol. 0.027 gm.	0.038 gm.

While the urine was collected for but a short time and for this reason the results may not be entirely accurate, the function of the right kidney by the urea-volume appeared to be less than that of its fellow kidney which harbored the stone. Because of the age of the patient, her poor condition and the gravity of nephrotomy, I did not care to remove the calculi

from her left kidney until the right kidney was functionating properly.

On the advice of Dr. Keyes I introduced a small cystoscope into the bladder and beside it introduced a small knife and incised the right ureter orifice. This proved to be an awkward way of operating and if the occasion should arise again I should use a simple open tube, pass the knife through the tube and incise the cyst. A couple of weeks before I incised the uretero-vesical cyst the patient complained of an entirely new pain in the right kidney region. This pain disappeared immediately after cutting the ureteral orifice. Two months later I passed a No. 7 F. catheter up the right ureter whose orifice I had incised.

At that time the function of the two kidneys was as follows:

RIGHT	LEFT
Vol. 44 c. c.	105 c. c.
Urea 5 gms. to liter.	2 gms. to liter.
Urea vol. 0.220.	0.210 gm.
Phenolsulphonephthalein 18% in first half hour.	10% in first half hour.

In this test by both the urea volume and phenolsulphonephthalein the function of the right kidney was better than the left. The calculi were then removed from the left kidney by nephrotomy and the patient made an uneventful recovery.

DISCUSSION

Dr. Charles H. Chetwood, of New York: I would like to cite a case similar in many respects to that of Dr. Fowler's—similar in the comparative absence of symptoms, with a good-sized stone in the bladder. The man gave a clinical history of having had intermittent attacks of hæmaturia, with some frequency of urination. A noteworthy fact was that such frequency as he had was not increased by the movements of the body in the daytime; in fact, he was compelled to rise at night to pass his urine. On that account I made a tentative diagnosis of probable neoplasm, but on introducing the cystoscope there was revealed a good-sized stone, about an inch and a half in length, attached to the upper portion of the bladder. The fact that it was not in the bas fond

PLATE VIII. — Presented by DR. BENJAMIN S. BARRINGER

Fig. 2. — Uretero-vesical cyst before incision

Fig. 3. — Case of double uretero-vesical cyst. The cyst on the left (right ureter) more advanced than the right.

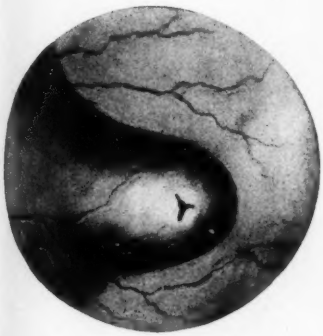


Fig. 4. — Same case as Fig. 3. Cyst of right ureter quiescent.

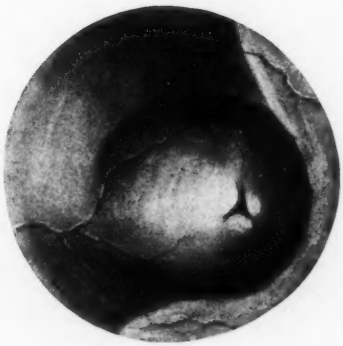


Fig. 5. — Same as Fig. 3. Cyst of right ureter during excretion of urine.

and touching the orifice explained the comparative absence of symptoms. This stone was also removed by litholapaxy, but not in the office with local anæsthesia. General anæsthesia was used.

DR. HUGH CABOT, of Boston: I have had one case similar to that of Dr. Binney, in which the diagnosis was made with the X-ray catheter. It seems to me that pyelography is helpful in diagnosis, but to-day when you can use a catheter the walls of which are filled with metal so that you can get a good full flow from the kidney without being interfered with to some extent by the fuse wire in your catheter, I think it is a method quite as valuable as pyelography. In cases similar to Dr. Binney's I think pyelography is attended with some difficulties and possibly with some danger. These are cases in which some stricture of the ureter is not uncommon, in which the injection of collargol is likely at least to be attended by some blocking up, and in the inflamed kidney is more likely to do harm than in the normal kidney. Our experience with collargol in pyelography seems to me to show that we ought to be a little cautious in its use, particularly in infected cases, and especially in cases where there is any narrowing of the ureter or any obstruction to the outflow. For these reasons it seems to me that the shadow-casting catheter is at least as valuable a method of diagnosis as pyelography.

In regard to the case reported by Dr. Barringer, I have had two such cases, in one of which the kidney was entirely or nearly entirely destroyed at the time that I saw the patient, and in the other case considerably damaged. In neither of those cases would the operation suggested by Dr. Barringer have been possible, because the cyst was practically entirely closed at the time, and was asymmetrical in such a way that the ureter orifice was on its under surface and was not accessible to the cystoscope. In neither case could we find any ureteral orifice in the cyst by the cystoscope, and in one of them no orifice could be found when the bladder had been opened. That was a case with practically entirely destroyed kidney, and that patient came to us on account of the symptoms of acute sepsis, the kidney having gone suddenly bad. Where such an operation as that described by Dr. Barringer is possible, it seems to me quite desirable, but I should incline to the view that unless we get those cases earlier than at present, it would not be practicable in many of our cases.

DR. RAMON GUITERAS, of New York: I have a case similar to that of Dr. Binney which I should like to show. This patient was a laborer, 32 years of age, who came into the hospital complaining of inability to

work on account of a feeling of inconvenience and discomfort and pain in the pelvis. On examining the patient standing he seemed to have retention of the urine—bladder retention. A catheter was passed, the urine in the bladder withdrawn, but the tumor still remained. On palpation with the patient standing the tumor was not apparent, but when the patient was lying down this tumor could be very easily made out. It seemed to be back of the bladder in the pelvis. Consequently, it seemed to me to be either a hydatid cyst, two of which I have seen behind the bladder, or else a tumor on the bladder wall. Following this I cystoscoped the patient and found a normal bladder. Therefore I concluded that if it was a tumor of the bladder, it was in the bladder wall itself and not in the bladder. There were various opinions in this case by men connected with the hospital.

After a time I operated, making an incision over the pubes, up toward the umbilicus. I went through the peritoneum, and found a bulging over the promontory of the sacrum and extending down into the pelvic cavity. This was a cyst, evidently, behind the peritoneum, and behind the cystic fluid I seemed to feel something indurated. I could not tell whether it was a bony growth or not. At any rate, I aspirated the cyst, and sent the specimen to the laboratory to see if any pus or urine were present. The answer came back that no pus or urine were present. I had thought of a displaced kidney, but as there was no urine found, I thought the kidney could be excluded.

The question then came up of what to do with this cyst. I thought I had better evacuate and drain it. I accordingly anchored the posterior parietal peritoneum to the anterior parietal peritoneum, and then opened the cyst and drained. I fastened the tube by tiers of strong sutures. A few days afterward it was noticed that the fluid coming from the cyst did contain urea and pus, showing that it connected with the urinary tract, therefore probably pointing to a displaced kidney and pyonephrosis. I then proceeded to take some radiographic pictures. The first picture showed that the catheter had slipped down in the ureter somewhat. The second picture showed the left catheter going up to the pelvis of the kidney, and the right catheter coiled up in this space over the promontory of the sacrum. In both cases the right catheter had gone up to about the last lumbar vertebra. In one of these pictures we were sure that the ureteral catheters had slipped down, and the other we had thought of the possibility of it. We then proceeded to do our radiography

with the X-ray catheters, keeping the cystoscope in place. Here we see the first picture, corresponding to the last one. We see that the left catheter is way up into the pelvis of the kidney, and the right one still coiling up in this space over the promontory of the sacrum. The patient was lying on his back. Then we had several unsuccessful attempts with collargol, and finally we obtained this picture. Here is the left catheter going up to the pelvis of the left kidney, which is injected. On the right side this catheter has gone up evidently farther than before, probably on account of the elevation of the pelvis of that kidney. Here you see the collargol around this area, and five ounces of collargol in the pelvis of that kidney. He had frightful colic afterward. But at the same time it seemed that we had had so many failures; we had injected collargol three or four times before, perhaps an ounce or more, and we thought this time we would make sure to have enough in. The patient had a sinus running from the pelvis of this kidney out and opening on the abdominal wall.

I would like to speak of the condition that I mentioned before of this tumor or cyst as it appeared after opening the peritoneal cavity. For instance, here is a cut of the body, the bony framework. Here we have the sacrum, here we have the ilium, and here we have the location of this tumor. It is just on the promontory of the sacrum.

In operating on this patient I made my incision just over the anterior spine, down around the anterior superior spine, and down between the outer border of the rectus abdominis muscle and Poupart's ligament until I came to the sinus. I had no difficulty in pushing away the tissues until I got down to the kidney. The kidney was enlarged and had a fibrous feel. I found it was adherent to the promontory of the sacrum and to the iliac vessels. The patient's pulse went to 160, and I had to discontinue the operation. I gave an intravenous injection and closed the wound. The patient recovered and is in good condition, and I hope to show the specimen at some other time. It is an interesting case, and if I had finished my operation I think without doubt the patient would have died.

Dr. John T. Geraghty, of Baltimore: I wish to speak of two cases similar to the ones reported by Dr. Barringer. The first case was in the left ureteral orifice, and did not collapse with the functioning of the kidney. As the kidney was so badly destroyed on that side, it was decided to do a nephrectomy, the X-ray showing numerous calculi. We hoped

that after the kidney would be removed the cyst would cause no further trouble. The nephrectomy wound closed and remained closed for several months, and then broke open. At the same time the patient developed great difficulty in urination, and on cystoscopy it was found that this cyst had grown almost to the size of an orange, and was pushed up against the prostatic orifice and almost producing complete retention. Through a suprapubic incision it was opened and the walls excised, and the cyst was found filled with pus.

In the other case it was possible to see the ureteral orifice collapse with each opening of the cyst. It was possible with Young's rongeur to go in and catch this cyst while it was functioning and exeise a good portion of the cyst wall. I saw the patient the other day, and the ureteral orifice on that side looks now practically normal, almost as if no operation had been done. The operation of incising the cyst wall through the cystoscope causes practically no bleeding and very little pain.

DR. G. S. WHITESIDE, of Portland, Ore.: I had a case similar to Dr. Fowler's, also operated in the office without anæsthesia, and a perfectly good result, but I do not approve of doing litholapaxy in the office, because I think it is altogether too painful for the patient, and possibly it is more dangerous where the patient is allowed to walk around directly afterward, instead of being placed quietly in his bed. There is a possibility of a blood clot being detached and lodging somewhere where it will be detrimental to the patient's well being.

DR. G. K. SWINBURNE, of New York: I find that sometimes we have to do litholapaxy in the office. I had a case brought to me by a physician who wanted me to operate on a man who had stone in the bladder. He was very uncomfortable with it. A surgeon in the city had told him he needed a suprapubic cystotomy to remove the stone, and his physician told him he did not need it, and brought him up to my office during my office hours. I put in the evacuator, as I often do to test the stone, and I found rather a small one, although it would not catch in the eye of the evacuator. Then I put in my lithotrite and crushed it with one crushing, and the whole thing came out in the evacuator.

The same week I had another case almost exactly similar. As a matter of fact, I have done now about fifteen cases, including those at the dispensary and at the office, which have been done under cocaine anæsthesia, and the patients have gone home. The stones have varied from the two just described up to one case in which there were two stones in

the bladder, each weighing 250 grains, and these were removed a month apart. That was the first case that I did in the dispensary. But it does not seem to me that it offers any great difficulty in doing it at the office. I always put the patient, if I can, on urotropin for at least a week.

DR. FRANCIS R. HAGNER, of Washington: Dr. Fowler and I had some little discussion about this in Washington some time ago. I have a very strong feeling about it myself. I do not believe in doing these operative procedures in the office. They can be done in uncomplicated cases, unquestionably, but the time is coming when some man will do a stone crushing in his office, that patient will go home and some accident will occur, and the surgeon will not escape censure. It is usually known as an operation which is generally done in the hospital, and if any accident should occur I believe it would almost ruin a man in the section in which he lives. I think we ought to consider this point. Dr. Fowler has done quite a number of cases in his office. I cannot help but think if he should have an accident it would be a serious thing for him, and I do not feel it is possible for a man to escape censure.

DR. EDWARD L. KEYES, JR., of New York: While I entirely agree with the views expressed by the last speaker, yet Dr. Chismore used to do them by the bushel, and if Dr. Fowler can do them as well as Dr. Chismore, he won't get into any trouble.

DR. FOWLER: As Dr. Hagner has said, we do not agree in this matter. I know exactly what his feelings are, as we have discussed this question elsewhere.

There are one or two points, however, that require emphasis. In the first place, we are working under a local anæsthetic, and where we are working under a local anæsthetic we are doing our work more carefully than where we work with general anæsthesia. In the second place, I believe that this operation is perfectly safe and satisfactory as an office operation *in selected cases only.* I think that is one of the things to be emphasized. By selected cases I mean those cases that can be done under local anæsthesia; in which there is no obstruction from hypertrophy, or a severe cystitis, which increases the danger either in the office or in the hospital; and in which the working capacity is ample. I believe in carefully selected cases that the operation under a local anæsthetic is just as safe in the office as in the hospital.

I have operated fifteen times on nine patients in the office, on stones varying in size from a very small one just too large to escape through the eye of the evacuator up to the size of the stone I passed around. In one case only have I had a post-operative rise of temperature. It was the ordinary urethral chill, which lasted a very short time, and it is not attributable to the litholapaxy any more than it is to any other instrumentation. I do not see any excuse in this certain, definite class of cases for sending these patients to the hospital for the removal of a small vesical calculus where the conditions are favorable for a litholapaxy under a local anæsthetic. I see no reason why this cannot be done just as well in the office as it can at the hospital. And I do not believe that there is the danger attaching to litholapaxy that perhaps we have associated with this operation—certainly not in the group of cases under discussion. If there is any bleeding or tearing of the bladder, that is not the fault of the operation, but of the operator, and is due to carelessness or inexperience. So that in this selected group of cases I see no reason why they should not be done in the office as well as at the hospital. If there is much bleeding there is trauma, and if there is trauma it is due to carelessness or inexperience. Our cases have been entirely satisfactory, and I shall continue to operate on these patients in the office until I have that misfortune which Dr. Hagner mentions.

Dr. Binney: Dr. Cabot spoke about the danger of pyelography in these pyonephrotic and displaced kidneys. I agree with him perfectly that the styletted or the radiographic catheter is, as a rule, much better than pyelography. In some cases, however, I think more exactness can be reached by outlining the pelvis with collargol, and it seems to me this can be done more safely by using a weak solution and leaving the catheter in place in the pelvis of the kidney, taking the X-ray at once, and then allowing the solution to escape, forcing it out by pressure if necessary, and in that way preventing a large residue of collargol from remaining in the kidney.

Dr. Barringer: In the two cases of uretero-vesical cyst that I have seen the ureters were in plain view; and in the first case, the one with the large cysts, I catheterized both ureters. Nevertheless, if, as in Dr. Cabot's cases, we cannot see the ureters, we cannot incise them and the suprapubic operation is indicated.

REGURGITATION OF FLUID FROM THE BLADDER TO THE KIDNEY DURING URETERAL CATHETERIZATION. REPORT OF A CASE.

By Francis R. Hagner, of Washington, D. C.

SINCE reporting on June 17th, 1908, my first case of regurgitation of fluid from the bladder to the kidney during ureteral catheterization I have noted this phenomenon in three other cases. They would unquestionably have escaped notice had we not been on the lookout for them. In all of the cases a chronic pyelitis was present; two tubercular cases, one double renal calculus case, and one case of pyelitis due indirectly to prostatic obstruction. In all other cases the ureter was thickened, causing more or less deformity of the ureteral orifice.

The bladder capacity of the different cases varied considerably, one of the tubercular being 95 c. c., the other 200 c. c.; the case of double renal calculus 275 c. c. and the case with prostatic obstruction 400 c. c. The first indication that this condition is present in a case is the unintermitting escape of pale fluid from the ureteral catheter. The method I have used in all my cases to prove the existence of this condition is as follows: the ureteral catheter is inserted into the ureter and passed to the pelvis of the kidney. The fluid from the bladder is then withdrawn, the ureteral catheter being left *in situ;* the bladder is then filled with 5% argyrol solution and as soon as the known capacity of the bladder is reached the black fluid will pour in a stream from the ureteral catheter, thus proving unquestionably that it has passed from the bladder through the deformed ureteral orifice around the catheter to the kidney pelvis and escaped through the lumen of the catheter. By the syphonage effect of the catheter in the ureter it is possible to run a great deal more of the fluid out of the kidney than one would consider could ascend to the kidney, after the bladder reached its full distention. It might

be possible to syphon all the fluid from the bladder if the ureteral catheter were left in place a sufficient length of time.

The first case, already reported, was a male 57 years of age with tuberculosis of both kidneys—the regurgitation occurred from the right kidney but not from the left. This was an inoperable case. The second case, observed in July, 1909, in a male 30 years of age, was not unlike the first, except that the patient had a larger bladder capacity, the left kidney being the seat of tuberculosis while the right was normal. This patient was operated upon, the kidney removed, and when last seen was in good health. No leakage after nephrotomy.

The third case, seen November 1st, 1910, was a male 62 years of age, upon whom Young's perineal prostatectomy had been performed September 21st, 1909, with a most successful result. The patient had no residual urine and no frequency, but was never relieved of his pyuria although frequent bladder irrigations with different fluids were resorted to. He was cystoscoped at Garfield Hospital November 1st, 1910; his bladder capacity was nearly 400 c. c.; evidence of mild diffuse cystitis existed. The right ureteral orifice was normal and urine collected from this side was free from pus; on the left side the ureteral orifice was of the typical golf hole variety and easily admitted a No. 6 ureteral catheter. Purulent fluids escaped in a stream from this catheter. The catheter was passed up the ureter 31 centimeters. I was suspicious that there was some regurgitation of fluid from the bladder in this case and it was so proved when I filled the bladder with argyrol. The patient is in good health but still has his colon bacillus infection and his pyuria.

The fourth case, May 24th, 1911, was a male 34 years of age. He had renal calculi in both kidneys and a double pyonephrosis; bladder capacity 275 c. c.; both ureteral orifices were thickened and showed evidence of chronic inflammation. On the day that I examined this patient Dr. Howard Kelly of Baltimore was present and I demonstrated this phenomenon

to him. He informed me that he had never known of its occurring or never heard of it before. The appearance of the ureters on the two sides was identical, yet regurgitation occurred only on the right side. Nephrotomy was performed on the right side, several calculi removed and the pyonephrotic organ which was gravely diseased drained. An effort was made to cause regurgitation from the bladder to the kidney without the presence of a ureteral catheter at time of operation but I was unable to demonstrate this. Although it probably does occur and accounts for the presence of a urinary fistula after removal of a kidney.

This patient lived two weeks, dying from a gastro-mesenteric ileus, demonstrated at autopsy. Examination of the unoperated kidney showed as many calculi and as grave lesions of the kidney structure as on the operated side. Both ureters were enlarged and very much thickened but dissection through the bladder wall of the ureteral orifice revealed no perceptible difference except possibly a little more thickening of the trigone on the right side than on the left.

I believe that this phenomenon occurs only in chronic inflammatory diseases of the ureteral orifices and is caused by the infiltration and cicatricial tissue formation in this region that causes a destruction of the valve-like arrangement in the normal ureteral orifice.

I do not know that this observation is of any great practical importance, as I believe it occurs only in the presence of chronic ureteritis affecting the lower portion of the ureter, but it could easily mislead an observer into thinking a pyonephrotic kidney was secreting fluid when in reality there might be no secretion at all, but a regurgitation from the bladder.

None of the monographs or textbooks on ureteral catheterization to which I have had access mention this phenomenon and as I have demonstrated four cases in four years, I feel sure that other cases have occurred and escaped our attention. I might add that being on the watch for this con-

dition I have had several other cases that I suspected, but in testing them out found that this condition did not exist.

DISCUSSION

DR. A. C. WOOD, of Philadelphia: The observations just described by Dr. Hagner are very interesting. The phenomenon is probably due to a reflex contraction of the bladder, which occurs when a certain degree of distention by the fluid is reached, and the fluid is forced up the ureter along the catheter, as it finds but little resistance in this direction. Whether this may occur in a normal ureter, or is an evidence of dilatation or other abnormal condition, is, it seems to me, an important question. I trust Dr. Hagner will settle this point for us.

I have very recently had a demonstration of the contraction of the bladder excited by the presence of a certain degree of distention. While irrigating a patient's bladder with a short nozzle connected to a graduated glass reservoir by six feet of tubing, after four or five ounces had passed, I was surprised to see the solution rise again in the reservoir, then flow again in the bladder, and when about the same amount had passed, be again forced back into the reservoir. This was repeated several times and wholly without any voluntary effort on the part of the patient, and even without his knowledge. In this case, an irritable condition of the bladder of long standing, causing frequent urination, had reduced its capacity apparently to a few ounces.

DR. EDWARD L. KEYES, JR., of New York: If I remember aright, Dr. Hagner made mention of this phenomenon some years ago at a meeting of this Association, and another member of this Association said it was a common occurrence in his experience. I had not observed it then. I, therefore, since that time have been keeping track of our cases, and certainly I have seen a number of them, perhaps three or four. Dr. Barringer, I think, has seen several of them with me in which the phenomenon noted by Dr. Hagner occurred. As one put the catheter up into the ureter and left it there (perhaps catheterizing the other ureter, at least before the bladder was empty and the cystoscope out), there was an obvious discrepancy between the flow of urine from that catheter and the other, such as one would get in hydronephrosis. It has seemed to me that I could not make out any particular rule to identify why one ureter

would regurgitate and one would not. All of those that regurgitated, I believe, were pathological ureters. On the other hand, that does not specifically count in my mind, for I can remember one case that not only did not regurgitate, but proved a very difficult one to catheterize. That was a man with a stone in his left kidney, and we cystoscoped him four times, and on two occasions were able to get a No. 4 catheter into the left ureter; that is, the ureter of the diseased kidney. On two other occasions we were unable to get any catheter into that ureter. After removal of his kidney he had regurgitation of his urine through the lumbar wound. The striking thing in this case was that the man had a very tight lower end of the ureter, and certainly regurgitated through the lumbar wound after the kidney had been removed.

DR. HAGNER: I have not very much to add. I think the explanation of the change in the flowing is just what occurs in these cases. You do not get it as long as the flow runs, but when the bladder becomes full and contracts, the fluid is forced up into the ureter. I thought possibly in these cases that the catheter might be lifting the ureter up and might allow the fluid to go in, but I have been careful to have the catheter go in as straight as possible, so I feel this is not a contributing cause.

I would like to ask Dr. Keyes if he could get the catheter inside the ureteral orifice?

DR. KEYES: On two occasions a No. 4 went up probably 20 cm. On the other two occasions no catheter could be introduced at all.

DR. HAGNER: At operation did you examine the ureter at all?

DR. KEYES: He had a pyonephrosis and a thickening of the ureter, and the orifice was obviously diseased.

DR. HAGNER: Could you pass anything down from above?

DR. KEYES: I did not try.

DR. HAGNER: Of course, the condition of the ureter that would allow this was probably present there, and the diameter of the ureter was lessened, yet I think the whole condition that causes it is right in the ureteral orifice, although he had a stricture farther up.

DR. KEYES: The stricture was within the first few centimeters.

DR. HAGNER: Even in the first few centimeters it might be perfectly possible to have that present and yet have regurgitation in that case and difficulty to catheterize.

UNILATERAL KIDNEY HÆMORRHAGE CONTROLLED BY INJECTION OF HUMAN SERUM.

By Benjamin S. Barringer, M. D., of New York City

BECAUSE of the brilliant results that Welch obtained when using normal human blood serum in *hæmophilia neonatorum,* I suggested the trial in December, 1911, of human blood serum in a case of unilateral renal hæmorrhage. The results in this case were as immediate and extraordinary as in Welch's cases.

The patient's history is as follows: A man, 36 years of age, said he had been suffering from " Bright's Disease " for a period of three or four years. During this time he has had hæmorrhages from various places: from a pimple on the chest, which he scratched when asleep; from the trachea; profusely and often from the nose. Three months before I saw him he had an attack of severe pain in the left side of his abdomen.

He presented evidence of shock, and was taken to the hospital by his physician. He rapidly became worse. There was distention of the abdomen, and his physician thought there was an intestinal obstruction. On laparotomy a large amount of free blood was found in the region of the descending colon, and a blood tumor as large as an orange was seen in the wall of the colon. This was evacuated and a bleeding artery found. The wound was drained and slow recovery followed.

During the operation it was discovered that his left kidney was about three times as large as normal. When he left the hospital he had albumin and casts in his urine. Shortly after this he began to have severe hæmaturia and passed urine bright with blood. When I saw the patient his urine was red with blood. I cystoscoped him and saw the bloody urine jetting from his right ureter. As his history was that of a " Bleeder," and as his bladder was entirely normal I did not

attempt either to catheterize his ureters or exclude tuberculosis or stone of the kidney. The first output of phenolsulphonephthalein was 9.5% the first hour; 46.5% the second hour. I sent him back to his physician, Dr. C. S. Lamb of New Haven, Conn., suggesting that he inject normal human blood serum.

The patient had three brothers. Dr. Lamb used all three of them in obtaining blood for serum; in the last injection combining the sera of two brothers. It was thought that the blood of one brother, whose blood was used for the first serum injection, coagulated much faster than the blood of the other two brothers. After the first injection of 20 c. c. the bleeding immediately stopped. This was followed in about four days with 50 c. c. of serum and three days later 130 c. c. The patient had absolutely no reaction following any of these injections. An examination of the urine after the injection showed no albumin.

At the present date, six months after the use of the serum, his physician reports that the patient has never lost one drop of blood since the first injection.

I wish briefly to touch upon some of the problems of the injection of serum and of the technic of injection.

1. *The class of cases in which serum injections should be tried.* First, in the bleeder. Second, in that class of cases variously termed bleeding of unilateral nephritis, renal papillitis or varicose veins of a kidney papilla. In seventy-three of this latter class which I have collected from the literature there was an operative mortality of 15%. In the attempt to cure the disease, twenty-seven kidneys were sacrificed in this series of seventy-three cases. The non-operative measures, internal administration of turpentine, injection of adrenalin into the kidney pelvis, seem occasionally to work and more often not. While it is difficult to say if the serum would have any effect in these cases it should certainly be tried both by subcutaneous injection and by direct application of the serum to the bleeding point in the kidney pelvis.

2 *Hæmolytic tests.* Human blood serum is injected in small quantities at first, 10 c. c. to 20 c. c. and because it is injected subcutaneously takes some time to become diffused throughout the body.

If there be any reaction, any "serum sickness," another blood serum may be used and hæmolytic tests be made. If the blood be obtained from any relative there is no fear of serum sickness and one may give as large a dose as wished.

Welch makes the general statement: "Human serum never gives serum sickness or causes anaphylaxis in the human subject." Certainly serum other than human is given every day without hæmolytic tests as e. g., diphtheria antitoxin. While serum sickness occurs in 20% of cases receiving antitoxin, fatal results are rare.

3. *Method of collecting blood for serum.* Welch gives a picture of an apparatus for collecting the blood which consists of a glass jar having a cork stopper with two holes to admit two glass tubes. One of these tubes goes to the needle which punctures the vein, and the other is for suction when drawing the blood.

In an emergency the blood could be collected in a sterile test tube and the serum taken from that.

4. *Method of giving serum.* If the renal hæmaturia be part of the diathesis, if the patient be a bleeder, then unquestionably the serum should be injected subcutaneously. If the bleeding should be due to a nephritis, uni- or bilateral, to a papillitis, to varicose veins of the kidney pelvis, small amounts of serum might be injected through a ureteral catheter.

The efficiency of direct application of blood, or blood serum to a bleeding point, was first discovered by Bienwald,[1] who applied the grandmother's blood to a bleeding cut on a child's head. The child was rapidly becoming exsanguinated and the bleeding stopped immediately after the application. If the serum be injected through a ureteral catheter, 5 to 10

c. c. would be sufficient and diphtheria antitoxin or any other handy serum might be used.

5. *Quantity of serum.* The initial dose depends upon the urgency of the case. In an emergency I should not hesitate to inject 40 or 50 c. c. of any relative's serum as the first dose, and, if no reaction ensues, to follow this in five or six hours with three or four times this amount. The amount of serum that can be injected without injurious reaction is given by Welch. In one case he gave to a dying new-born child 10 c. c. of serum three times in the first day. In another case he injected 209 c. c. in five days.

6. *Duration of Cure.* As yet no one seems to know how long the one-time bleeder will remain a non-bleeder after the injection of serum. It is possible that the quantity of serum administered has an effect upon this. Dr. Lamb's patient was given 20 c. c. of rabbit's serum six days after the operation for intestinal bleeding with the object of controlling any subsequent hæmorrhage. Six weeks after this injection his kidney bleeding began.

7. *Other Effects and Uses of Serum.* In addition to its effect upon the coagulability of the blood it is an accepted fact that human blood serum has a distinct bactericidal action.

If the kidney bleeding is caused or accompanied by infection the serum will help overcome this infection. A third virtue is its nutritive value; the patient has had just so much good food. This, of course, is of much more importance in cases of *hæmophilia neonatorum.*

DISCUSSION

Dr. A. L. Chute, of Boston: I would like to ask Dr. Barringer about how long it takes to prepare this serum, whether it is a thing that is readily done? That is the part of this paper that he apparently omitted. It seems to me that it is interesting.

Dr. Louis E. Schmidt, of Chicago: I would like to state in connection with this work that Dr. Victor Lespinasse, of Chicago, has extracted a principle from human blood and has applied it clinically in a great

many cases of hæmorrhage, particularly in nose and throat work, where it so often happens. Simply the mere application of the powder will stop the hæmorrhage. Dr. Bremerman used this preparation in connection with a case of hæmaturia from one kidney. A very small quantity was mixed with water in the form of an emulsion, injected into the renal pelvis, and the hæmorrhage, which had existed for a great many weeks, immediately ceased, and three or four weeks later there had been no hæmorrhage. I am sorry to say that there was no diagnosis made in this case as to the cause of the hæmorrhage. Up to the present time it has also been applied in several cases of bladder hæmorrhage, and local applications have stopped the bleeding.

Dr. H. A. Fowler, of Washington: I am very much interested in these cases of unilateral renal hæmaturia, particularly as to their etiology. I gather from Dr. Barringer's paper that in his case he thinks the hæmaturia was due to a constitutional dyscrasia, or hæmophilia. I believe Senator first advanced this view to explain the hæmorrhage in his case.

I have had eight cases of profuse unilateral renal hæmaturia. In four of these cases the operation showed the lesion underlying the hæmaturia to be that of chronic interstitial nephritis, while in the other four cases the diagnosis was made entirely on the clinical evidence. I think one is justified in making the diagnosis of nephritis as the basis for renal hæmaturia in these cases if one can exclude the other usual causes, particularly tumor. In one case the patient has been under observation now for seven years. In that length of time one is justified in excluding tumor as the cause of the bleeding, and as other lesions in the kidney which give rise to hæmaturia have been excluded, I think we are justified, on the basis of exclusion, in calling that case one of chronic interstitial nephritis. This patient has been kept under observation. From time to time he has shown an intermittent hæmaturia, the period of bleeding varying from a few days to weeks. When he first came under observation he had been bleeding for several weeks, and without internal treatment or without any local measures, such as ureteral catheterization, the hæmaturia gradually subsided, to reappear at a subsequent period, and then subside and reappear again.

I might say further that I believe that in all cases of unilateral renal hæmaturia there is an organic basis, a pathological lesion, always present to explain the bleeding. I do not believe that the cases of so-called idiopathic renal hæmaturia will bear close investigation and analysis. Those

cases that were reported, following Senator's paper on hæmophilia and Klemperer's paper on angio-neuroses, will not bear strict analysis, but really show that the bleeding was due to some organic change in the kidney or ureter. I believe that in the majority of these cases chronic interstitial nephritis, either simple, focal or diffuse, will be found as the pathological basis for the hæmaturia. The question of the relation between chronic interstitial nephritis and dilatation of the veins, or varicose veins of the papillæ, is very interesting, and one that has not been settled. I am specially interested because I had a patient in whom the lesion was very definite, lesions of chronic interstitial nephritis with intratubular bleeding, and in which there were dilated veins, dilated more than one usually finds in cases of congestion of the kidney. And I have wondered if possibly this was not an intermediate stage between the lesion of chronic nephritis and the final stage of the development of varicose veins that one often finds in these cases. It was not a condition that one would describe as varicosity of the veins, but one of marked dilatation, and suggested an intermediate stage in the development of this condition of varicose veins of the papilla. If that is true, these varicose conditions bear the relation of effect, the cause being the underlying nephritis.

This is an ingenious method of treatment that Dr. Barringer has proposed, and adds another one to the already considerable list. Ureteral catheterization sometimes, we know, does control bleeding. The cases reported by Dr. Hagner are very striking and very convincing. I have not believed that the injection of adrenalin through the ureteral catheter into the renal pelvis has very much of a deterrent effect on the bleeding. It seems to me that the reflex effect of ureteral catheterization is more of a factor in stopping the bleeding than the addition of adrenalin injections. Dr. Barringer has given us another method of treating these cases, but we must remember that in these cases of profuse renal hæmaturia sometimes the bleeding subsides spontaneously without local treatment or without internal medication. Spitzer has recently reported two very interesting cases of this kind. These cases were under his observation, and the bleeding was so profuse that it offered a vital indication for operation, and this was proposed to the patient, but was refused because the patient wanted to go to Berlin for some family or social reasons. One of these patients came under the care of Israel. He failed to make a definite diagnosis as to the etiology of the bleeding, but believed that the condition present was one that justified immediate operation. The patient still demurred, left the

clinic, and within two or three days the bleeding subsided, and the patient was rapidly restored to normal health. This is a very striking illustration of the fact that in these cases of profuse unilateral renal hæmaturia oftentimes without treatment the bleeding will subside for the time being, only to recur later.

As to the etiology of these cases, I believe that in the majority of them chronic interstitial nephritis is the basis of the trouble. That does not explain the bleeding; that simply gives a foundation for it. Why a kidney, the seat of chronic interstitial nephritis, should bleed, is a question that perhaps it is difficult to determine. There must be as a result of the lesion present in the kidney some disturbance in the renal circulation, probably a congestion, but, curiously enough, in many of these cases when the kidney is exposed, congestion of the kidney has not been found, and so it is rather difficult to explain the final etiology.

Dr. Charles L. Gibson, of New York: Some years ago I had occasion to explore one of these kidneys, and found no gross lesion. In order to make the operation sure, I split the kidney right down into the pelvis, without finding any demonstrable lesion whatsoever. The incision was closed up by a few sutures, but the man continued to bleed, both downward through his ureter and through the wound. The bleeding was so progressive that the man became greatly anæmic, and his life was in jeopardy, and I finally had to take his kidney out. That kidney was examined very thoroughly, and absolutely no abnormality whatsoever was detected.

I am very much interested in this, and I trust Dr. Barringer next year will give us a report on the condition of the patient a year hence. I cannot help wondering, theoretically, speaking of injecting this serum, whether it might not be wise to choose a female relative rather than a male, because the theory of hæmophilia is that the female line does not transmit the disease, although they may bleed themselves. Of course, the opportunities for experimentation are very limited that way, but it would be very interesting to see whether there is anything in that.

Dr. Ramon Guiteras, of New York: This question of renal hæmaturia as due to medical nephritis is a very interesting one to me, although I have not studied it with the same degree of care that Dr. Fowler has. But I recall two cases the recital of which may be of interest.

The first case had rather profuse hæmorrhage, and had had it for about two years. I operated on him seven years ago simply by a neph-

rotomy. I found no pathological lesion present, although he had the symptoms of interstitial nephritis, and an examination of the urine from that kidney at that time showed that he had that disease. He has never had any hæmaturia since that time.

Two years ago a patient came to the city who had a diffuse nephritis with bleeding from the left side. We watched that patient for two years. We treated him by different methods, and nothing had any effect upon him excepting iron mixtures, which perhaps tended to diminish the amount of bleeding more than any other remedy. Sometimes this patient would pass bloody urine every day; sometimes he would go two or three days without passing bloody urine. During the time that he passed the bloody urine, which varied from a light pinkish red to a port wine color, he lost only five pounds in weight. Finally I determined to operate on him. I operated two months ago. His kidney was opened into the pelvis from the convexity. No pathological lesion was present, either in the pelvis or in the parenchyma, to vision, and for two weeks after the operation he would occasionally pass a little blood, and now two months have passed and his hæmorrhage has stopped. I just mention this case as showing how a patient with nephritis can pass bloody urine for a long time without losing more than five pounds in weight.

Dr. Francis R. Hagner, of Washington: I reported some years ago a case that had ureteral bleeding for a year. I catheterized his ureters and it immediately stopped, and he had no recurrence. But two or three years later he had a thrombosis affecting the vessels of his spermatic cord. His scrotum was enormously swollen and black, and these thrombosed vessels could be distinctly felt. That gradually disappeared. Whether there was any connection between this condition of his kidney and the condition of that cord, I cannot tell.

The case that had bled for thirty-five years is alive and well to-day. He has never had any recurrence. This was eight or ten years ago, and he is now working every day and perfectly well. His urine was microscopically free from blood at the end of a week. The man weighs now about forty-five pounds more than he did at the time his ureter was catheterized.

Dr. Fowler: I want to speak of ureteral catheterization in three cases of those four that were not operated on. In three cases ureteral catheterization was followed in the next forty-eight hours by a clearing

up of the hæmaturia, the urine becoming microscopically free from blood. To me it was very striking. Of course, these are recent cases, and it is too soon to tell what the ultimate effect will be, but to my mind there was no doubt whatever of the immediate marked effect upon the hæmaturia of ureteral catheterization in these three cases.

DR. BARRINGER: I wish to thank the members for the very full discussion of this subject.

In answer to Dr. Chute's question as to the time it takes to prepare the serum: I do not prepare this serum. Dr. Welch has suggested a little apparatus, simply a flask with a rubber cork and two tubes through this going into the flask, one for the needle with which to get the serum, and the other for a suction apparatus to produce a vacuum in the flask so the blood will run easily. After the blood has been obtained it takes from four to six hours for the serum to begin to collect, and then the injection is immediately done. Simply draw off a certain amount of serum, and inject it as you would diphtheria antitoxin.

Dessicated horse serum has been suggested, as Dr. Schmidt has said, and used with good results in a number of cases. I do not see any reason why we should use a dessicated serum when we have the diphtheria antitoxin, or when we can get human serum.

As to the bleeding stopping spontaneously: in the paper that Dr. Fowler referred to that I published a short time ago, I emphasized that fact—a case in which I had done a nephrotomy the bleeding stopped immediately after the nephrotomy. The bleeding recurred at the end of two or three years in this case. I catheterized his ureters and injected adrenalin and the bleeding stopped. It came on again a few months later, and I did everything that has been suggested, catheterized the ureters and injected adrenalin in good quantity into his kidney pelvis, and finally sent him home and told him to take life easy. His bleeding stopped within two or three weeks, and has not, as far as I know, recurred since.

I think Dr. Fowler gave a very good explanation of the cause of the bleeding; that is, the blood vessels of the papillæ are very thin-walled, and if a nephritis occurs, causing a slight change in the circulation of the kidney, it is not strange that we should have hæmorrhage from these thin-walled vessels.

I shall be very glad to give a report on this case at the next meeting.

ACUTE UNILATERAL HÆMATOGENOUS INFECTIONS OF THE KIDNEY

By JOHN H. CUNNINGHAM, JR., M. D., of Boston

SUPPURATION within the kidney parenchyma results from infection by one or another of certain varieties of microörganisms taking place in one or two ways, either as an ascending infective process from the lower urinary track or from the blood stream.

As ascending kidney infection is not the subject under consideration, this matter may be dismissed by the simple statement of fact that such ascending infection of the kidney never takes place unless there is some defect in the mechanism of the ureteral orifice which may permit of a reflux of infectious bladder urine into the ureter and kidney.

The acute renal infections of hæmatogenous origin are of two distinct classes: one induced by infective or toxæmic conditions, for example, nearly all of the infections which give rise to general diseases, such as diphtheria, scarlet fever, measles, smallpox, pneumonia, typhoid fever and other acute general infections. The disturbance within the kidney is due in this class to the action of toxic substances elaborated by the virus of the special disease and which is in part eliminated through the kidneys. While the toxic substances of these acute general diseases conveyed to the kidney by the blood streams do induce cellular necrosis, it is rare that suppuration occurs and the resulting kidney disturbances remain medical rather than surgical.

It is the second rather smaller, yet more serious, class of kidney infection of hæmatogenous origin whereby the kidney is invaded by the microörganisms themselves, resulting in acute inflammation and suppuration that commands our attention from a surgical standpoint.

Acute suppurative nephritis of hæmatogenous origin is a condition resulting from the invasion of the kidney by certain

microörganisms in particular by the pyogenic cocci and the colon bacillus. It is theoretically of a metastatic nature, and when encountered in both kidneys is usually consecutive to septic endocarditis or other septic affections elsewhere in the body. When it occurs in but one of the two kidneys the primary focus from which the organisms find their way to the kidney has seldom been determined.

The pathology of acute unilateral hæmatogenous infections of the kidney is quite different from the acute bilateral kidney infections. The latter is an expression of a general septicæmia or pyæmia in which the kidneys may participate. The former, the acute unilateral kidney infections of hæmatogenous origin, is not a part of general pyæmia, but finds its origin in the lodging of a minute embolus carrying one or several organisms alone in the terminal vessels of the kidney. It is probable that as a rule the process is started by a single microörganism. The condition starts not by multiple simultaneous infections throughout the kidney as the lesions observed in the kidneys removed at operation might suggest, but as a single focus in the cortex of the organ. When the organisms settle in the minute capillary vessels of the glomerulus, an inflammatory reaction is set up around the glomerulus and the surrounding tissue is infiltrated with the products of inflammation. From the primary focus of infection other areas are secondarily involved by the infectious material gaining access to other tubules, to the lymph spaces and through the vessels in the connective tissue stroma. The infection thus is more or less rapidly spread through these channels to other parts of the organ.

The pathological process originating as above described is of two distinct types: 1. *Abscess formation;* 2. *A diffuse inflammatory process without breaking down of tissue.*

In the former type of the disease, *abscess formation,* the kidney is found somewhat enlarged from congestion, and disseminated through its substance are small separate foci of suppuration or miliary abscesses surrounded by areas of con-

gestion. In the early stages of this disease these minute abscesses are often observed in the cortex just beneath the capsule. From here other parts of the organ are secondarily involved, as just mentioned. If the process continues, these foci may enlarge, coalesce and form abscesses of larger size which may rupture the kidney capsule, invade the perirenal fat, resulting in a perinephritic abscess. For the infection to complete this cycle the resistance of the individual must be great and the virulence of the infecting organism comparatively slight as the systemic toxæmia from this disease is rapid, and death usually occurs before the process develops to this stage. The organisms producing this form of kidney inflammation are the pyogenic cocci, the staphylococcus pyogenes albus and aureus and the streptococcus pyogenes.

The histology of the condition is seen in Fig. 1.

The second type of the disease, *a diffuse inflammatory process,* spreading through the kidney substance, but not resulting in focal abscesses or solution of tissue has the same sequence of events in its pathology when of hæmatogenous origin. This type of the disease presents a pathology more commonly the result of an ascending infection but is encountered as a process of hæmatogenous origin and results from an infection of the organ not by the pyogenic cocci as does the abscess type but by the colon bacillus. The difference in the severity of the process depends upon the lesser virulence of the infecting organism. The organ is found to be enlarged from congestion. There may be subcapsular areas of more or less acute reddening and on section the organ is found to present irregular circumscribed acutely reddened or pale yellowish areas involving the cortex and pyramids, or involving nearly the whole organ, but without solution of tissue. In the early stage of the process these isolated areas are distinct and are seen as irregular acutely reddened patches, with the edges streaked downward into the pyramids. As the inflammatory process subsides, these areas lose the acute red color and are replaced by tissue of a paler character. In some instances the

whole kidney may present an acutely reddened surface due to the acute process involving the whole organ. This form of the disease undergoes resolution without focal degeneration of tissues, and when seen after the acute process has subsided, presents paler areas dependent upon the stage of the connective tissue repair process. The histology of the condition in the acute stage of this type of the disease is seen in Fig. 2.

By studying the clinical course of these two forms of the disease, it becomes evident that the clinical signs differ in some respects, and each has a definite relation with these two different pathological conditions. The subjective and objective signs which the patient presents should suggest the type of process at work in the affected kidney. These two types of the infection should be recognized upon inspection of the diseased organ at the time of operation, for experience has shown that these different types of infection do not require the same form of treatment. While the kidney containing numerous focal abscesses requires nephrectomy, less radical measures suffice in the diffuse non-suppurative form of inflammatory infection.

From the *clinical aspect* of the subject the picture which *unilateral multiple abscess formation* produces is an acute disease which may or may not be ushered in by a chill. There is a rapid rise of temperature to 102° to 105° F., an early acceleration of pulse rate usually to 120 or higher, occurring often within twenty-four hours following the onset. The picture of sepsis or toxæmia and a high leucocytosis develops rapidly. Pain on the side of the affected organ, abdominal tenderness, muscular rigidity and spasm is found on the affected side. Lumbar tenderness, rigidity and spasm are pathognomonic signs of the disease. The abdominal signs are similar to those occurring in acute affections of the appendix and gall-bladder for which the disease of the kidney under consideration is often, if not usually, mistaken. Unfortunately the urine in this disease does not excite suspicion of

PLATE V. — Presented by Dr. John H. Cunningham, Jr.

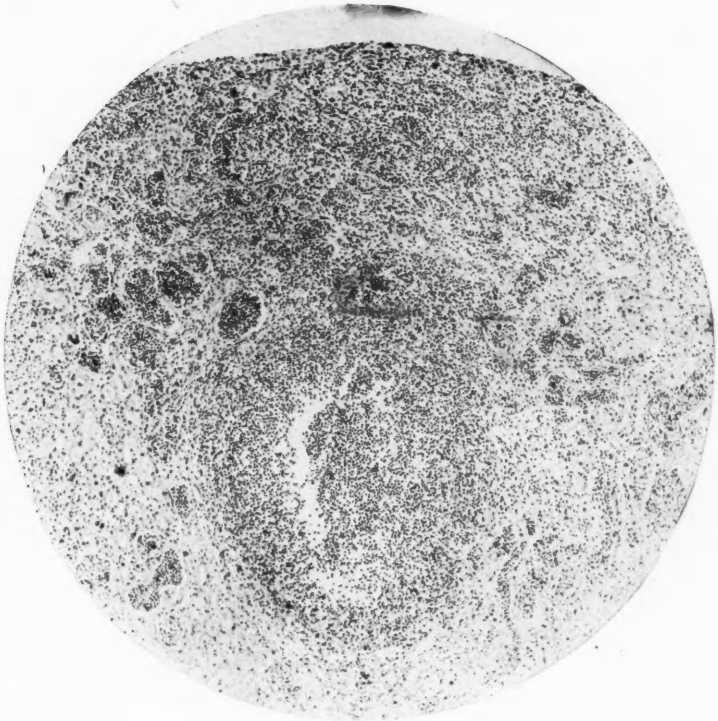


Fig. 1

Acute inflammation of the kidney, with abscess formation. Note miliary abscess; tubules filled with polymorphoneuclear leucocytes.

the true condition, as it is usually quite normal in its gross and microscopical appearance and generally contains but little albumin and only a small amount of pus and blood cells, because the abscesses find no avenue of escape through the collecting tubules which are either plugged by the product of inflammation or compressed by infiltrated tissue surrounding them.

When the infection is severe, the patient grows progressively and rapidly worse, the toxæmia becomes profound, delirium sets in and there is a fatal termination within a few days unless the body is rid of the infected organ.

Of this form of the disease the writer has observed four cases.

Case 1. Woman, thirty-eight years old, entered the Gynæcological Service of the Boston City Hospital under the care of Dr. Franklin Newell and Dr. Ernest Young on March 27, 1912. The past history was negative, with the exception that one year ago both tubes, ovaries and the appendix were removed for acute inflammation.

The illness for which the patient came to the hospital was characterized by severe pains in the right kidney region, chills, fever and vomiting beginning three days before entrance and gradually increasing in severity. The temperature at entrance was 103.4° and the pulse 120, leucocytosis 28,000. The general condition of the patient was poor. The physical examination showed a flushed face, throat and lungs negative, anæmic murmur in the heart. The abdomen was not distended but showed general tenderness in the right half, much more tender than the left. Exquisite tenderness in the right upper quadrant and in the right loin. There was rigidity of the right rectus and lumbar spasms. Vaginal examination was negative. The urine was turbid, 1020, acid, slight trace of albumin, no sugar or bile. The sediment was small in amount and consisted chiefly of pus, an occasional blood corpuscle and epithelial cells. The patient's condition became progressively worse during the following two days, and on the third

day after entrance to the hospital (six days after onset of the trouble) it was extremely bad. At this time the writer saw the patient in consultation with Dr. Ernest Young. Her appearance was that of profound sepsis, pulse 130, of poor quality, temperature 103°. There was rigidity of the right side of the abdomen with marked tenderness over the right kidney in front and in the back. The urine at this time was only turbid and contained but little pus. The leucocytosis was 18,000.

It was believed that the patient had a nephritic or a perinephritic abscess. An operation was advised as the only chance for life, although the risk was considered great.

A lumbar incision was made, the perinephritic fat found infiltrated with cloudy serum but no pus. The kidney was exposed and delivered. It was twice normal size, congested and over the surface were scattered many focal abscesses from 1 to 5 millimeters in diameter. The pedicle was clamped and the kidney removed. No attempt was made to tie the pedicle on account of the poor condition of the patient, stimulation and salt solution being required during operation. The clamp was left on the pedicle, the wound drained by a spiral tube with gauze and the wound partially closed.

Twenty-four hours after operation, the patient's temperature dropped to 100° and the pulse to 110. The improvement in appearance and general condition was perceptible. The clamp was removed from the kidney pedicle on the sixth day. The patient made an uneventful recovery.

The pathological report was acute inflammation of the kidney, with multiple miliary abscesses from which the staphylococcus pyogenes was recovered.

At present (five months after operation) the patient is in good health and the urine negative. The etiological factor producing the kidney infection could not be traced.

Case 2. Woman, thirty-two years old, seen in consultation with Dr. Albert F. Griffiths and Dr. Nathaniel Thayer at the Swedish Hospital, Brooklyn, N. Y., on September 27, 1907.

PLATE VI. — Presented by DR. JOHN H. CUNNINGHAM JR.

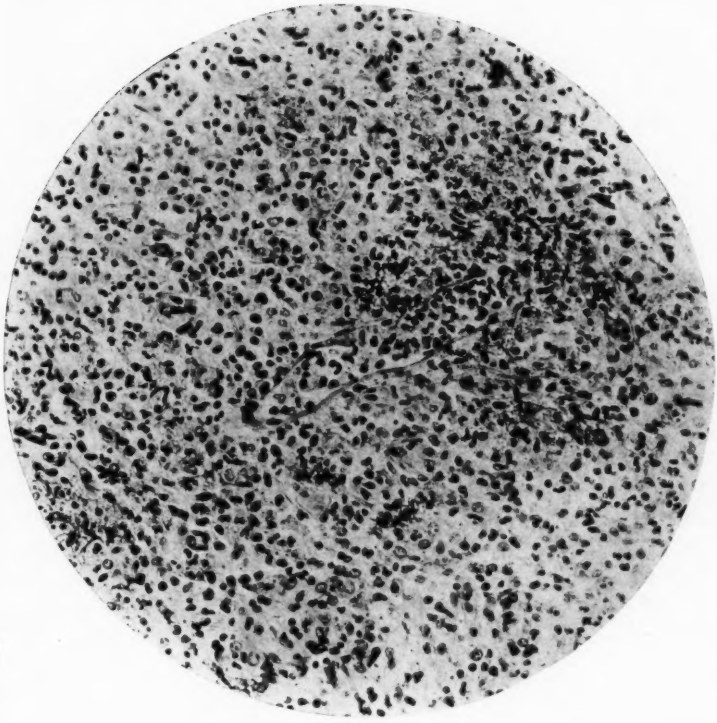


Fig. 2

Acute inflammation of the kidney of diffuse type, due to colon bacillus. Note that the lesions consist of inflammatory exudation, endothelial leucocytes with considerable fibrin formation and few polymorphoneuclear leucocytes. The exudation is both in tubules and between them. There is no tissue solution.

The history is as follows: Previous health excellent. Two days ago, began to have pain in right kidney region, chill, rise of temperature to 103°, and urine became cloudy, contained 0.25% albumin and considerable sediment, consisting of pus, normal and abnormal blood, but no casts. The pain became more severe, and her general condition failed rapidly. When seen by the writer the general condition was poor, temperature 103.5°, pulse 108, urine as above mentioned. There was tenderness over the whole right side of the abdomen, rigidity of the right rectus, and muscular spasm over the right kidney in front. There was an exquisite lumbar tenderness with spasm. The kidney was approached through a lumbar incision, the perirenal fat found to be œdematous and adherent to the kidney capsule in the central third of the organ. The kidney was freed and delivered, found to be about one-third larger than normal and much congested. In the middle quarter an area about one and one-half inches in length of irregular surface, slightly harder than normal, was found. This area extended over the anterior and posterior surfaces of the kidney to within about three-quarters inch of the renal pelvis. The kidney was split in the convex border and the area observed on the surface was found to involve the central quarter of the kidney down to the renal pelvis. This area, darker than the surrounding tissue, contained several small foci of purulent material from one to four millimeters in diameter. The remainder of the kidney showed only congestion. A wedge shaped piece including the centre third of the kidney and passing about one-half inch outside of the infected area was resected. The upper and lower remaining thirds of the kidney were then brought together by mattress sutures and the capsule was united by interrupted catgut sutures. The wound in the back was united around a tube and gauze drain. The temperature dropped to normal on the second day following operation and the abnormal elements disappeared from the urine. The patient left the hospital fifteen days after the operation with a small clean granulating wound.

The improvement in general condition was rapid and the patient has remained well since.

The pathological report showed acute inflammation with multiple abscess formation.

CASE 3. Woman, 34 years old, presented the following clinical history. About five months ago had an illness characterized by fever, pain in the right side of abdomen and back. It was considered appendicitis by the attending physician. Remained in bed about two weeks, at which time the symptoms had disappeared. An indefinite pain remained in the right kidney region, more noticeable after physical exertion. Three months ago had a similar acute attack.

On August 1, 1906, the patient was again taken acutely ill, and when seen by the writer, had a temperature of 101.8°, pulse 110 and a leucocytosis of 18,000. The urine was negative except for a slight trace of albumin and a few pus and blood cells. There was severe pain in the right hypochondrium and an acute tenderness and rigidity over the right rectus and in the right costo-vertebral angle. The appendix region was negative. During the following two days the temperature rose to 104, pulse 120, and white count to 22,000. The urine remained the same. The pain, tenderness and rigidity became more marked and the patient began to look toxic. The diagnosis of acute inflammation of the kidney was made. The kidney was approached through the lumbar region, the perirenal fat found œdematous and the kidney about one-third larger than normal. Beneath the capsule were many small miliary abscesses. The pedicle was clamped, the kidney removed. The pedicle was tied and the wound closed about a rubber tube with gauze.

Within two days the temperature and pulse had fallen to normal, and the general condition of the patient was much improved. The patient last seen two years ago was well. The pathological report was acute inflammation of the kidney with abscess formation, areas of scar tissue.

Case 4. Woman, 33 years old, presented the following history. Previous health excellent. Four days ago she was suddenly taken with severe pain in the right upper quadrant of the abdomen accompanied by vomiting. Has felt feverish and has had several chills during the past few days. When seen by the writer, November 15, 1908, the temperature was 102.4°, pulse 108, white count 17,200. In the right hypochondrium there was marked tenderness and rigidity. In the costo-vertebral angle exquisite tenderness and muscular rigidity. Urine slightly high in color, 1014, acid with a trace of albumin. The sediment was small in amount and contained many leucocytes, rare normal and abnormal blood cells, hyaline and brown granular casts, and occasionally fatty renal cells, a few squamous epithelial cells. The patient remained in this condition without much change for four days, when it became evident that the toxæmia was becoming more pronounced. The kidney was approached through the lumbar region, the perirenal fat found œdematous, the kidney somewhat enlarged and beneath the capsule could be seen many discreet abscesses about two to four millimeters in diameter. A nephrectomy was performed, the pedicle tied, the wound drained; the temperature and pulse fell to normal on the third day, the abnormal elements disappeared from the urine except for the presence of epithelial cells. The pathological report was acute inflammation of the kidney with abscess formation. The patient has remained well since operation.

The clinical picture produced by a *diffuse inflammatory process* within the kidney *without abscess formation* differs from that *with abscess formation* chiefly in the severity of the symptoms. The onset may be sudden, as in the former type, the temperature rising rapidly to 102 or more, associated with acceleration of the pulse rate; and a leucocytosis is always present, often high. A chill may accompany the onset. Pain in the loin on the affected side is an early symptom, sometimes indefinite but often severe, varying according to

the severity of the process. Tenderness over the kidney in the costo-vertebral angle, with some muscular rigidity and abdominal tenderness and rigidity on the affected side are constant signs. The chief feature differentiating this form of the disease from that of abscess formation is the lack of progressive toxæmia, and the presence of more abnormal elements in the urine. These patients, while appearing acutely ill, do not have the real progressive toxic course which characterizes the other form of the disease. The illness after the first few days following the onset remains more or less stationary and may continue not unlike a beginning typhoid fever. The pain, tenderness and muscle rigidity may become gradually more pronounced, and the temperature, pulse and leucocytosis elevated; or the different signs may gradually decline. Remissions in the acute symptoms occur, but indefinite pain on the affected side usually persists indefinitely, and recurrences of the acute symptoms are not uncommon.

The writer has observed four cases in this type.

Case 5. Woman, 43 years old, seen in consultation with Dr. H. W. Baker, and Dr. A. W. Tucker, of Lynn. Thirteen years ago the patient had a severe illness characterized by pain in the right side of the abdomen and back, fever, chills and cloudy urine. In bed several weeks. Since that time has had several similar attacks which confined her to bed for from two weeks to three months, and different physicians who cared for her have considered that in these attacks she was suffering from peritonitis. Some advised operation, which the patient refused. Between these attacks there has been a constant pain varying in severity in the left kidney region. Several X-ray examinations have shown nothing abnormal. Four years ago the patient had a small amount of blood in the urine during one of these attacks. This occurred again two years ago. It never lasted more than a few days.

On February 2, 1912, the patient was cystoscoped by Dr. H. W. Baker and a collargol injection and radiogram were

made of the left kidney. The cystoscopy showed the bladder to be normal in all respects, both ureteral orifices were normal, and the catheters were passed to each kidney. The specimen of urine collected showed that from the right side to be normal, and that from the left to contain a few leucocytes, normal red cells and caudate epithelial cells. The capacity of the renal pelvis was 14 cc. The radiogram of the injected kidney pelvis showed it to be normal.

On February 14, 1912, the writer again cystoscoped the patient, and found the condition as previously stated. An injection of six milligrams of phenolsulphonephtalein showed the dye to appear on the right side in six minutes, on the left in nine minutes. The total amount recovered in two hours was, right 25 per cent, left 10 per cent. On account of the persistent pain an exploratory examination of the kidney was undertaken. Temperature at the time of operation was 102.2°, pulse 100, leucocytosis 8,100. The operation was performed February 16, 1912. An anterior incision was made. The peritoneal cavity was opened and explored. Nothing abnormal was found. The peritoneum was closed and stripped toward the median line, exposing the left kidney retroperitoneally. The perirenal fat was found adherent to the kidney capsule. The kidney was but little larger than normal, and several grayish depressed areas were seen beneath the capsule. On section showed many pale grayish, sclerotic areas, some near the cortex, others in the pyramid. The remainder of the kidney was reddish yellow, and there were acute red streaks near the apices of the pyramids.

In view of the history these areas were considered to be old resolved foci of acute inflammation. It was believed that the persistent pain following the acute attack was probably to be explained by these contracted areas, and the kidney was therefore removed. The fat about the pedicle was adherent to the vessel, and as they could not be entirely cleaned the pedicle was clamped and the wound closed about the clamp, which was removed on the fourth day. The patient made an

uneventful recovery except for an infection which took place in the wound.

Pathological report is as follows: The surface presents several opaque grayish areas which are depressed and contracted. Some of these areas are surrounded by a small area of injection irregular in outline. On section several similar but smaller opaque areas not surrounded by areas of injection are seen scattered throughout the kidney substance. Near the upper pole is seen an area two cm. in diameter, symmetrical and definite in outline containing another area which is apparently a blood clot. The capsule of the kidney strips easily leaving a red surface in places. Cortex measures six mm. and glomeruli are indistinct. Histological diagnosis is acute, diffuse inflammation of the kidney with healed areas.

Three months after operation the patient was in the best health which she had enjoyed for many years. She was free from pain, and the urine was normal. She had gained thirty-four pounds in weight. Eight months after operation excellent health continues.

Case 6. Man, 31 years old, seen in consultation with Dr. Richard Collins at the Waltham Hospital, January 25, 1910. Since childhood the patient has had a chronic discharge from the right ear. About ten years ago had a severe attack of pain in the right kidney region the facts regarding which are indefinite. Five years ago had a similar attack and passed a small amount of blood in the urine. Confined to the bed for a short time. Four years ago had a similar attack associated with frequent urination. Since this attack has had pain in the right kidney region, almost constantly. About two years ago he had another attack associated with fever and frequent urination and passed more small amounts of blood in the urine several times.

Five days ago, after a hearty dinner, patient had a severe attack of pain in the right side, associated with chill and vomiting. Then admitted to the Waltham Hospital, acutely ill, with pain in the right side, temperature 102, pulse 104.

Acute symptoms gradually subsided, but pain in the back persisted. X-ray examination was negative. Seen by the writer February 25, 1910. The patient's condition as above noted. A cystoscopy performed at this time showed the bladder urine to be slightly cloudy and contain fine shreds. This urine was 1020 in specific gravity, acid, and the sediment showed considerable pus, small round and many squamous epithelial cells. There was considerable fresh blood. Trigone was normal. Both ureteral orifice normal in size and character. About three-quarters inch above the right ureteral orifice was seen a group of eight or ten acutely injected areas from which bleeding had taken place and on which were adherent blood clots. These areas were a little larger than the head of a pin and resembled early tuberculosis of the bladder. The remainder of the bladder was normal. Both ureters were catheterized and the urine collected from both was equal in amount. The examination of the urine from the left side showed little abnormal, that from the right side considerable pus and normal blood cells; a few caudate and small round cells. Guinea pigs inoculated for tuberculosis did not develop the disease.

On January 29, 1910, an exploratory examination of the kidney was undertaken on account of the persistent pain and cystoscopy findings. The kidney was exposed through the loin. Perirenal fat was but slightly adherent to the kidney. Kidney delivered and found slightly larger than normal. Beneath the capsule were seen a few grayish white contracted areas and a few acutely red areas. Nothing abnormal in the remainder of the kidney or kidney pelvis. The kidney was split in Brœdel's line. In the region of the contraction seen on the surface there were hard grayish areas about one and one-half centimeters in diameter, similar pale contracted areas were scattered through the kidney tissue. There were two acutely reddened areas in the upper half of the kidney. Believing the persistent pain to be due to these contracted

areas, the kidney was removed, the pedicle was tied and the wound drained.

The temperature which was 101.5 at the time of operation dropped to normal within twenty-four hours. The wound healed by first intention.

The pathological report was an acute, diffuse inflammation of the kidney with healed areas. The colon bacillus and staphylococcus pyogenes aureus were recovered from the tissues. The last organism may have been a contamination.

The last heard of the patient was about one year following operation, when he reported as well.

Case 7. Long Island Hospital. Woman, 24 years old, giving a previous history of syphilis four years ago. Treated with mercury continuously for three years.

On January 7, 1910, laparotomy was performed by another surgeon because of severe pain on the right side of the abdomen associated with spasm and tenderness over the right rectus muscle. This time the temperature was 102.5. A few small cysts of the ovary were found and a normal appendix was removed and a thorough exploration of the remaining abdominal organs proved negative. Following operation the pain in the right side persisted, the temperature ranged between 101 and 104 and the pulse around 120. The white count was around 14,000. This condition persisted for about one week, when the temperature returned to normal, the pulse to 100 and the pain and tenderness became much less.

One week later the pain again became severe, the temperature rose to 102 and the right side of the abdomen and back became very tender. Examination showed marked tenderness and involuntary spasm over the right abdomen and back. White count was 23,000. The patient remained in this condition for about one week, when symptoms again gradually subsided. The urine at this time showed but a trace of albumin, a small amount of pus, single and in clumps. A few small round cells and granular casts.

Two weeks later another acute attack of pain on the right side. Temperature rose to 102, pulse to 120. The twenty-four hour amount of urine at this time was 550 cc. The sediment at this time showed more pus, many small round epithelial cells and a few hyaline and granular casts. A Rœntgen ray examination was negative.

The writer first saw the patient in this attack. At this time there was general abdominal tenderness and spasm, more marked over the right side. There was exquisite tenderness and spasm in the right costo-vertebral space. The general condition was only fair and suggested toxæmia. The diagnosis of acute inflammation of the kidney was made and operation undertaken.

An anterior incision was made, the peritoneum opened, the abdomen explored and found to be negative. The anterior incision was closed. The kidney was then approached through the loin. The perirenal fat was found adherent to the kidney and a hard nodule about the size of a Concord grape situated in the perirenal fat was removed. The kidney was slightly larger than normal and showed many red areas beneath the capsule. On section of the organ similar areas were found scattered through the kidney substance. Nephrectomy was performed, the pedicle tied and the wound drained.

Four days following the nephrectomy the patient developed a right lobar pneumonia which a few days later involved the left side and death occurred eleven days after operation. The wound at this time had healed except for a small granulating area.

The pathological report showed acute inflammation of the kidney with several areas showing connective tissue repair. The bacillus coli was recovered from the tissues.

Case 8. Woman, 48 years old, seen in consultation with Dr. H. W. Baker, March 2, 1912. The patient presents a history of having had repeated attacks of pain in the left kidney region associated with fever, chills and vomiting. These attacks confined her to bed for periods of weeks many times

during the past five years. Since the first attack there has been constant pain in the left kidney region and during the past year the patient has been unable to lie down in bed and has been obliged to sleep sitting up on pillows. On March 1, 1912, the patient was cystoscoped by Dr. H. W. Baker. The bladder was found to be normal. Both kidneys were catheterized. The urine obtained from the right side was acutely red with fresh blood with a few squamous and large round cells. The fresh blood was believed to have been caused by the catheter. The urine of the left side was slightly cloudy and showed a few pus cells, single and in clumps, many squamous, polygonal and large round cells, many clumped with fat drops adherent.

The patient was seen by the writer on March 4, 1912. She was a poorly nourished woman weighing 110 pounds and complained of severe pain in the left kidney region. There was tenderness in the costo-vertebral angle. The temperature was 99.4 and the pulse 108. As a result of the consultation it was decided that an exploratory operation of the kidney should be made.

Operation March 10, 1912. The kidney was approached through an anterior incision, the peritoneal cavity opened and explored. Nothing abnormal was found. The peritoneal was closed and stripped toward the median line, exposing the kidney. The perirenal fat was slightly adherent to the kidney. This was freed and the kidney delivered. The organ was of normal size and rather pale. The organ was split in Brœdel's line. The cut surface showed the tissue everywhere to be paler and firmer than normal, and as there were no focal changes in the kidney tissue and the structure of the kidney was normal other than for its pale character, it was decided not to remove the organ. The capsule was stripped; the kidney fixed in position, and the wound entirely closed.

The patient made an uneventful recovery. The wound healed by first intention and two months following operation there is but slight pain of the old character which comes only

after unusual exertion. The urine still contains polygonal and large round cells with a small amount of fat. Six months after operation the old pain had entirely disappeared and the urine contained but a few squamous epithelial cells.

It is believed that the pathological process present in this kidney was a connective tissue repair of a diffuse inflammation involving the whole kidney. The kidney was left in this patient as more or less of an experiment.

During the past few years the writer has seen five patients in whom all signs pointed to a diffuse acute inflammatory unilateral process of the kidney in whom the symptoms subsided without operation. In two of these cases the colon bacillus was isolated from the affected kidney by means of the ureter catheter. The only sign of the disease remaining in these cases has been an indefinite pain in the region of the affected organ. In but one of these patients is this constant, and in the other four it may be considered absent, except during periods of fatigue. The urine in all shows but little abnormal.

In conclusion I would like to say a few words in regard to the treatment in these two classes of cases.

In the first class the single kidney with multiple miliary abscess formation from which malignant toxæmia results, the organ must be sacrificed in order to save the patient's life.

In the second case of this class, mentioned in this report, only the central quarter of the kidney was involved. While this infected area was completely removed by a resection of a middle third of the kidney and the healthy upper and lower third united successfully and the outcome of the case was most favorable, this procedure must be considered most hazardous and cannot be recommended. Woolsey (Annals of Surgery, October, 1906) reports a similar instance in which he successfully removed the lower third of the kidney for the same disease. In the other three cases of this class, here recorded, nephrectomy was performed, and it is felt that in each instance it was the only means which could have been

employed to save the patient's life. All these patients are living to-day and are free from symptoms, considering themselves well.

While house surgeon at the Boston City Hospital, the writer observed two cases of this form of the disease. One upon whom Dr. Paul Thorndike did a nephrectomy followed by recovery, and one in which Dr. F. S. Watson did a nephrotomy with drainage followed by death from progressive toxæmia.

The proper treatment in the second class, the type of diffuse, acute, unilateral inflammation of the kidney, is not so clear cut and must depend upon the course of the disease in the individual case. As a broad rule it is felt that palliation, forcing fluids and the employment of urinary antiseptics, fortifying the patient's strength by a nutritious diet and stimulating drugs should be instituted at the outset and operative interference should only be undertaken when the symptoms and physical signs give evidence of progression to the point of lowering the general resistance by toxic absorption. The time to operate upon this class of cases requires experience with the disease and judgment in regard to the patient's general condition. Some of these patients recover without operation, as noted by Brewer, Cobb, and the five cases mentioned in this report.

When an operation is undertaken in this class, nephrectomy is not the only procedure to be employed. Favorable results have been obtained by simple decapsulation (Cotton, Annals of Surgery, November, 1911), by puncture of the infected areas with drainage (Brewer, Trans. Am. Surgical Association, Vol. XXVI, 1908, and Cobb, Annals of Surgery, Vol. 48, 1908), and by splitting the kidney, closing the kidney wound by suture and decapsulating the organ as in the fourth case of this class recorded in this report.

On the other hand, when the symptoms and signs are of a distressing nature and the affected kidney is found to be the seat of old as well as new inflammatory processes, or when

the acute process is extensive, as in cases 5, 6 and 7 of this report, nephrectomy is the best procedure.

In closing I desire to express my sincere thanks to Dr. F. B. Mallory, Director of the Pathological Department of the Boston City Hospital for his help in preparing the pathology of this subject and for most of the pathological reports.

DISCUSSION

DR. CHARLES L. GIBSON, of New York: I have been very much interested in at least one of the points that Dr. Cunningham brought up; that is, the question of whether we have any resources in these cases excepting a nephrectomy. I had one instance some years ago in which I did a partial operation that was attended with such instant improvement of the symptoms that I am inclined to think there is a limited field for this procedure. This was a woman who came in with a febrile condition, repeated chills, high temperature, and desperately ill. The diagnosis was made largely from the constitutional symptoms and the fact that she had great pain in the side and changes in the urine. Catheterization of the ureters could not be carried out. At operation on exposing the kidney, at first sight when it was delivered, it did not look abnormal, but realizing that some of these conditions might escape superficial observation, decapsulation was performed, and at each pole of the kidney, clusters of miliary abscesses were found. We shaved off the tissue until we got rid of these areas. Within twenty-four hours the woman's symptoms had entirely subsided, and she made a perfect recovery.

I did a more or less similar operation once in a case that perhaps does not come under this class—more chronic—where two or three abscesses were nearly confluent in the upper pole of the kidney. These I simply opened and scraped out.

In one case, having been forced to do something in a tuberculous kidney, and having some doubts as to the integrity of the other kidney, I resected the middle section of that kidney, taking out a wedge, the rest of the kidney being sound, so far as the gross appearance was concerned. So far as the operative procedure was concerned, that seemed to be a success; the wound healed well, there was no drainage, and no discharge; but the operation failed to benefit the patient, as she gradually faded away, and died in the course of a few weeks with increasing chronic diffuse nephritis.

I do think there is a future for some of these conservative operations on the kidney.

Dr. Charles H. Chetwood, of New York: There is one notable fact that I think is worthy of mention in connection with these cases—and I refer to those of the focal abscess class—and that is the absence of bacteriæmia and the inability to obtain by a culture of the blood the peculiar organism that is responsible for the lesion. From my experience and knowledge of the literature, I think that it is very unusual in most cases to find the organism from a blood culture. It is found, of course, in the pyæmic cases that come in the classification under medical subdivision, but in the so-called unilateral infarctions of the kidney, the presence of the organism in the blood must be a transitory one, because we seldom hear of simultaneous occurrence of other foci elsewhere. The kidney seems to contain the sole focus. It is only in the cases that break loose and become fulminating after infection of the kidneys that we do find the organism in the blood, and then it will be fatal. It would almost make one doubt the transitory presence of the organism in the blood and accept the theory of the lymphogenous origin of such infarctions.

Dr. Francis R. Hagner, of Washington: I want to congratulate the doctor on his paper. I have had no experience that I recognized with the first group of cases that he speaks of. I had one case that might possibly have been that. It was a boy about 17 years old, with a perinephritic abscess, and after the abscess was opened the condition did not improve. This boy had a history of furunculosis, and the staphyloccoccus aureus was found in the perinephritic pus at the time of operation. About two weeks later he developed a fæcal fistula through the wound in his side. The boy left the hospital, and no further history of the case is known.

I had a case of the second class he speaks of in a child 10 years old. This child had a history of tonsillitis, and had recovered from the tonsillitis. Following this there was an unexplained fever, and finally the child developed some pain in the loin. I saw the child, examined her, cystoscoped and catheterized the ureters. Found a few leucocytes on the right side, the other side being normal. Blood cultures were taken in this case, and they were negative. An operation was advised. It was more or less exploratory in character. The kidney was exposed and split from pole to pole. Two infarcts were found in the kidney. One was either a healed infarct or else a bland infarct. There was some little connective tissue in it when it was examined afterwards. There were no organisms

at all. Cultures taken from the other infarct showed a staphylococcus aureus growth. This infected infarct had a deep red area, with liquefaction going on in the center. The other was more solid and paler in character. Both were dissected out and the kidney closed and drained. This child had been running a temperature of 102 to 103, and within twenty-four hours her temperature was normal, and she recovered.

Dr. A. L. Chute, of Boston: It seems to me that there is another side to this thing. I should like to report a case that I saw about twenty months ago. This woman had had some rectal operation, I think for a fistula, and she developed pain in the left side, elevation of temperature and rapid pulse. I catheterized the ureters and found a bacteriuria from the left side. The urine was filled with organisms. We watched her for a day or so, and she kept getting thinner. We then cut down on the kidney, and found it covered with these little miliary abscesses that Dr. Cunningham thinks are of such bad omen. We opened up a few, but could not open them all. We immobilized the kidney so that we could get at it if sepsis went on. We thought it would be wise to try this, being suspicious that a good many of these kidneys had been taken out unnecessarily. We simply provided adequate drainage. The temperature went down in forty-eight hours. The amount of serum which she poured out was terrific. They had to keep changing the dressings continuously for several days.

It seems to me that a kidney that looks very bad oftentimes does get well, and it seems to me that an extremely wise precaution, if you are in doubt, is to immobilize these kidneys, so that if you have to reopen the wound within twenty-four hours, you can do so easily. I think a great many that have been taken out would have gotten well and left a good kidney, functionally speaking.

Dr. J. Bentley Squier, of New York: One case I would like to speak about. I have also reported it under the title, "Recurrent Miliary Abscesses of the Kidney." Dr. Hagner has seen this patient, and he probably can say something about it. That man's renal history dates back twenty-three or twenty-four years. During that period up to the time of operation, sixteen months ago, he had repeated attacks of pain over the left kidney, and temperature, running at times to 104 or 105, and during these attacks he was very acutely ill. These attacks came on once or twice a year with great regularity. During them he would have pus in his urine. As far back as 1888 Dr. Nicholas Senn had advised

nephrectomy. Unheeding this advise he went on for a period of twenty years, during which time he was invalided at least two or three months every year.

In October, 1910, returning from abroad, he was taken sick the day before the steamer landed, and had to be carried to his home. The attack lasted for two or three weeks, when his temperature became normal, and the pain in his kidney subsided, and his urine began to clear up.

About a months after that, however, he had another attack, in which he was again extremely ill, and I advised operation on the kidney. This time he acquiesced, although a number of other consultants thought it was rather poor policy. The kidney was exposed and a nephrectomy done. The kidney looked pretty good when we cut down on it. There were some adhesions to the upper pole. I felt, though, in view of these twenty-odd years of illness that it was a wise thing to take it out. The kidney was excised and sent to Dr. Wood of Columbia University for analysis. He found a great many abscesses studded through this kidney, miliary and very minute in character, some of them giving the appearance of healed abscesses, or in the process of healing. There was one, however, at the upper pole of the kidney which was about the size of a hazel nut which was apparently responsible for the attack. The man made an uneventful recovery, and it has now been sixteen or eighteen months since the operation, and he has had no further trouble.

In another case a man was going through an acute attack of urethritis. He developed pain over his kidney, a rise of temperature, and was very acutely ill. I felt that there must be a gonorrhœal extension into his kidney and that it would require drainage. I exposed the kidney and found a very fair looking kidney. I was very much chagrined for having opened the man. I thought if multiple puncture of the testicle was a good thing for acute epididymitis that it might be a good thing to make multiple puncture of the kidney, which I did. His temperature came down, his pain was relieved, and he made a rapid recovery. The pus in his urine cleared up. I punctured the pelvis and got a little urine. A culture grown from this showed the colon bacillus, and we could not separate any gonococci from the urine.

DR. EDWARD L. KEYES, JR., of New York: I should like to express a degree of skepticism as to my ability to distinguish in operating upon such cases, between the cases that require nephrectomy and those that do not. While I have not been able to distinguish clinically the cases of bacterial from those of actual suppurative nephritis, we all distinguish

cases of more or less acute renal infection, occurring either without previously known chronic infection, or in the course of a previous chronic infection, in which we are inclined to be conservative, and watch the patient, with the expectation that such an acute attack will subside, as it usually does if there is no gross change, such as stone or retention, to make it continue. Sometimes I have felt, however, as the weeks rolled by and the patient kept on having a little temperature, that probably a good deal of time would have been saved if he had been submitted to some palliative operation on the kidney. On the other hand, there are fulminating cases, with chills and a temperature of 105°, that we obviously have to attack at once.

I have never done a palliative operation so far as I can recall. I have three times removed a kidney in a hyperacute condition, and I have been struck more than once, both in the specimens I obtained myself and those I have seen obtained by others, with the great difficulty in distinguishing the degree and the distribution of the suppuration. In one case of mine, particularly, I remember removing a kidney because it obviously had to be removed for a hyperacute condition, and at the time of taking it out, feeling gravely doubtful whether I was doing the right thing, splitting it open after taking it out, looking at the cut surface, and at first being unable to see any gross lesions other than acute congestion, so that it seemed likely that a decapsulation, or even immobilization—which I think is a therapeutic measure—or a nephrotomy, or some such palliative measure as that, might have helped the patient and saved the kidney; and yet when that kidney was submitted to microscopical examination it was found to be one mass of acute suppurative infiltration and minute miliary suppuration. And, therefore, I feel grave doubts as to the value of partial nephrectomy or any other procedure in the hyperacute cases.

In the not hyperacute cases the question is whether we shall do palliative operations—in such cases I prefer decapsulation, as suggested by Dr. Brewer—or whether we shall leave the patient alone.

DR. CUNNINGHAM: I want to thank the gentlemen for discussing this subject, which I think is very important.

In regard to Dr. Gibson's remarks about resection, of course, it should be our primary motive in all kidney operations to save as much of the kidney as possible, but in this particular disease I think it is very difficult indeed, even when the area seems to be circumscribed, to feel that we are safe in taking out the part we see and feel that other foci are not left.

We are dealing with multiple infections in the terminal vessels of the kidney, and I think the condition is not unlike the acute miliary abscesses that Dr. Alexander has pointed out to us in the prostate, in which condition he recommended removing the organ as the only sure way of getting rid of the infection.

Dr. Chetwood's observation that the organisms are seldom recovered from blood cultures is, I think, consistent with the course of this disease. It is probable that we have very few organisms in the circulation in the unilateral infections of the kidney. The few organisms that are in the circulation lodge in the kidney and stay there, unless the inflammatory process produced infects the general economy as a terminal infection. In this connection it is interesting to express the views of Dr. Mallory, who has done a great deal of work on acute infections of the kidney. His belief is that these abscesses start by the lodging of a single organism in the terminal vessels of the kidney. He has slides which show the lodging of a single tubercle bacillus in a certain area, and other areas which contain but two or three. His belief is that these one or two organisms, lodging in a particular spot, start the process, and from there other parts of the organ are invaded by infectious material descending the tubules to the pelvis, ascending through the collecting tubules into other portions of the kidney, or by gaining access to the tubules by continuity, or invading the blood vessels in the connective tissue stroma, thereby distributing the organisms to other parts of the organ.

Dr. Chute's feeling that we should be more conservative I think is a feeling that we all want to entertain. The only question is whether the facts in these cases warrant our doing so. I think Dr. Brewer's first series of cases, in which some patients died without recognition of the true condition, and the occasional autopsies on patients dying from acute disease, apparently of the abdomen, showing the true condition to be acute unilateral inflammation of the kidney; also patients that have been operated on and nothing found, and at autopsy acute miliary abscesses of a single organ detected are significant. I think in view of Dr. Brewer's observations in his early cases and these occasional post-mortem findings that the weight of evidence is in favor of sacrificing the organ.

I think Dr. Hagner's case illustrates what Dr. Mallory has presented to me in the pathology of this condition, a single focus containing the organisms and another focus from which Dr. Hagner was unable to recover the organism—that is, a primary focus and a secondary focus.

In this case he considers one either bland or healed. This latter area may have been the primary focus, or it might have been a secondary one. It is very difficult indeed to say, but I think a study of the histology of this organ would give evidence that one was the primary and the other a secondary infection of the organ.

SOME OBSERVATIONS ON CASES OF PROSTATIC OBSTRUCTION PRESENTING OVER-DISTENDED BLADDERS

By Arthur L. Chute, M. D., of Boston

THE more I see of prostatic cases the more I am convinced that we as urinary surgeons have not sufficiently impressed upon the medical public the tremendous importance and significance of the overdistended bladder in cases of prostatic obstruction. In our enthusiasm for perfecting operative measures for the relief of this condition I feel that we have not put sufficient emphasis upon what one may call an even more fundamental point than the sort of technique that one shall employ in operation. The functional result we get after an operation for the relief of prostatic obstruction, I grant you, depends upon the correctness of our operative technique, but whether the patient lives or dies depends much more on whether or not the patient has an overdistended bladder, and the renal condition that so often accompanies it.

As the bladder is merely an organ of convenience, its overdistended and atonic condition would amount to little, if the effects were confined to the bladder itself, but they are not. In practically every prostatic, in whom the bladder has become overdistended and atonic, there takes place in time an incompetence of the sphincter of the ureter. This depends upon the fact that the fibres that give the sphincter action to the lower part of the ureter are inserted into the wall of the bladder, and any continued overstretching of the lower seg-

ment of the bladder wall is attended with loss of function of these fibres. With the giving away of the ureteral orifice there follows a dilatation and atony of the muscular wall of the ureter and kidney pelvis, with the result that the secreting tissue of the kidney is affected by back pressure.

We see what I believe are two types of this back pressure from an overdistended bladder: the aseptic that is not always recognized and is by far the more dangerous type; the suppurative that is bad enough, but whose presence is evident from a very slight examination of the urine, and in which the patient has developed a certain immunity to infection.

I am in doubt as to whether we should consider the aseptic condition simply an embarrassment of the kidney function, or whether we should consider it a form of nephritis. I believe the latter is the more accurate interpretation. I have no pathological evidence on this point, as the patients whom I have lost from this condition have either not come to autopsy or have presented the infected kidneys that so quickly follow almost every surgical procedure in these cases of aseptic back pressure. However, the slight trace of albumin, the polyuria, the low solids, the occasional presence of a few casts, I believe point to definite tissue changes in the kidney: to a type of nephritis. That this condition is not a nephritis of the interstitial type is evident from the low blood pressure that I have found in instances of this sort. The great improvement, too, that these patients show after relief of their back pressure points to the fact that in addition to the nephritis there is a considerable embarrassment or interference with the renal function that depends upon the element of back pressure alone and from which recovery is rapid.

In the second type, the suppurative, there is no doubt as to the nature of the renal lesion; it is a frank suppurative pyelonephritis.

The thing that makes these prostatics with back pressure especially dangerous is the fact that they are often bordering on uræmia without showing marked symptoms. This is es-

pecially true of the aseptic cases. Ether, which is used as an anæsthetic in far the greater number of prostatic operations, is very likely to precipitate the uræmia. The recognition of this condition and its appropriate preliminary treatment allow one to operate safely in a considerable number of instances where one otherwise could not. I do not believe, however that any amount of care and preliminary treatment will allow one to operate safely on all these patients. In some the destruction of kidney tissue has gone too far.

The difference in the *mortality* of the occasional prostatic operator and that of the man who operates frequently is largely due, I believe, to a failure on the part of the occasional operator to recognize this renal condition, or if he recognizes it, to justly estimate its dangers.

I wish to report several cases of this sort that for the most part have come under my care relatively recently, and to draw attention to some points that I think are of interest and importance.

The two types of cases will be considered separately, as they present differences in the diagnosis, prognosis and treatment.

Case I. A physician of 59 whom I saw in November, 1911. For a year or two this patient had gotten up once at night to urinate. Occasionally he had wet his bed a little, but he had never had any urinary pain or frequency of urination. In the Spring of 1911 he was passing a low gravity urine in very large amount, almost four quarts a day. He was very fat and the overdistended bladder was not discovered. In the presence of a small prostate and very marked digestive symptoms a diagnosis of diabetes insipidus was made and the patient was sent to Europe for a rest. He was placed on a " salt free " diet, and with the exception of one or two upsets got on very well during the summer. When I saw this man in November, 1911, his overdistended bladder had been found, but the absence of urinary symptoms and the prominence of

gastric symptoms had raised the question whether this was not an intraabdominal growth.

This man was nauseated, had a dry tongue, a bad tasting mouth and was rather twitchy. He passed on his first day in the hospital forty-four ounces of transparent urine having a specific gravity of 1010, urea 1.67%; it contained the slightest possible trace of albumin and showed a little normal blood, a few leucocytes and an occasional cast. He had a feeling of fullness in his abdomen but no pain.

The gradual withdrawal of his residual was begun. Every precaution that I knew was observed. By the third day his urine had begun to be a little hazy. On the fourth day his enuresis had stopped, but his twitchings continued. On the sixth day his bladder was completely emptied: thirty-seven ounces in the morning, forty-seven in the afternoon. That evening he had pain in his bladder. The seventh day constant drainage by catheter was attended with a little bladder pain and a slightly blood stained urine.

On the tenth day, because of trouble with the catheter becoming blocked, it was inserted well into the bladder, beyond the outlet, a manœuvre that insures less trouble from blocking but necessitates leaving a small amount of urine in the bladder. His blood pressure at this time was 140 mm. of mercury.

By the twelfth day he was passing 105 ounces of turbid urine, with a small trace of albumin, sp. gr. 1009, urea 1.51%. He was at this time excreting one gram of salt in each 500 cubic centimeters of urine, while a short time before he had required 1000 cubic centimeters to excrete the same amount. His nausea had ceased, his tongue was moist, his appetite fairly good, and he was having no twitchings. This man's impending uræmia had apparently been warded off, and I felt that in a short time I could safely remove his prostate under spinal anæsthesia.

On the fifteenth day he passed 112 ounces of urine having a specific gravity of 1011, and containing 1.39% of urea. In the evening there was severe pain in his left loin and bloody urine.

On the sixteenth day his urine was partially suppressed: twelve ounces in twenty-four hours. The next day under injections of benzoate of caffein and subcutaneous infusions of salt solution the amount went up to thirty ounces. He had attacks of colic of the renal type, after which I washed from his bladder long " worm like " clots.

On the eighteenth day he passed 110 ounces of urine. In the afternoon he showed for the first time a little temperature (100.5°).

From this point there was a gradual failure, the quantity of urine steadily diminishing and the toxic symptoms increasing in spite of treatment. The urine continued bloody. By the twenty-first day the urine had dropped to sixty ounces; by the twenty-second to forty ounces. On the twenty-third day this man died of renal insufficiency. There was no autopsy.

Case II was seen in October, 1911. The aseptic period of this man's renal insufficiency was not actually observed by me, but it antedated my attendance by a very short time. This patient, aged sixty-seven, had nocturnal incontinence a number of years before. This continued for a time and then ceased. It had recurred, and had been especially troublesome during the summer of 1911. He had lost weight and strength considerably during this time, but had been without pain.

Ten days before I saw him he had had a severe gastric upset. He was advised by one physician, on the strength of finding albumin and a few casts, that he had Bright's disease. Another man found no evidence of Bright's disease (blood pressure 150 mm. Hg.), but did find a much distended bladder and an enlarged prostate. The surgeon to whom this last man sent this patient for confirmation of his diagnosis, drew

by catheter four pints of clear residual, with a specific gravity of 1010 and a slight trace of albumin. Following this the patient was catheterized at irregular intervals. His digestive trouble increased, and for a few days before I saw him he had had great difficulty in retaining food. The morning of the day I saw him a quart of bloody urine had been withdrawn. He had had some pain referred to his bladder.

When I saw this man he had a dry tongue and urinous breath. I withdrew twenty ounces of bloody, infected urine, having a specific gravity of 1011, urea 1.26%, albumin 3 *per mille*. His general appearance, however, was so good that it was hard for me to believe that this man's condition was so critical as I knew it to be. He was sent into a hospital and regular catheterization begun. Forty hours after I first saw him his bleeding had increased to the point where his bladder was filled with clots and a catheter was useless. I therefore did a suprapubic cystotomy as rapidly as possible under ether. In spite of saline infusions and stimulants, this patient lapsed into unconsciousness, had suppression of urine, and died about twenty-four hours later.

These two cases present several points in common. The first was in the aseptic stage when first seen; the second only recently infected. Neither one had suffered any pain until his bladder had become infected, presumably because their bladders were too atonic to resent mere overdistention. I think we should look with great suspicion on a prostatic who has a distended bladder and no pain. It indicates that his bladder is lacking in contractility, and that it will, and probably already has, allowed back pressure to take place. For the most part these painless cases will be in the aseptic stage. I have no explanation to offer as to why certain bladders distend easily and painlessly, while others do not.

In passing I would like to call attention to the nocturnal incontinence that these men presented, and say that, in the absence of a definite cord lesion, nocturnal incontinence in men practically always means an overdistended bladder. In

instances where the urine is clear and there is no pain this symptom seems unfortunately to be often overlooked. One may say the same for the digestive symptoms, which are even more commonly seen than incontinence, and the true significance of which is so frequently misinterpreted.

The rapidity with which these men's urines became infected, after they were catheterized, is of interest. We are told that to infect a bladder by passing a catheter, under ordinary circumstances, shows either a great lack of care or of skill, and I quite agree to this. With an atonic bladder the condition is wholly different, in my opinion. The urine as a rule contains just enough albumin to make it an excellent medium.

It has been my experience that I have been unable to carry on catheterization for any length of time in cases of this sort without getting infection. I have used the strictest aseptic precautions such as wearing sterile gloves, a careful toilet of the glans, and sometimes have used a preliminary urethral irrigation, these in conjunction with the use of urinary antiseptics, but the result has always been the same. There are enough organisms in the urethra so that I believe we must assume that we are going to have an infection of the overdistended aseptic bladder if we catheterize. We should not, however, because of the certainty of infection let up in the least regarding our aseptic precautions, for the longer we can put off infection the better.

Once the bladder has become infected in these cases with atonic bladders, and therefore gaping ureters, infection of the kidneys is almost sure to follow. The severity of this infection of the kidneys, which will take the form of a pyelonephritis, is a matter that is most difficult to calculate. It depends upon factors that we cannot determine: the general resistance of the patient, which is usually not very good; the virulence of the organism; the amount of change in the ureter and kidney pelvis; if this last is small, a slight diminution in the distention of the bladder may allow the kidney pelvis and

ureter to contract and take up their function, which is undoubtedly a protection against ascending infection, as well as an important element in ridding the kidney of an infection that has already taken place.

The hæmaturia these patients showed is of interest to me. I believe it was renal in both instances. In the first patient it followed lumbar pain, and I washed from his bladder long clots that were unquestionably casts of his ureters. It is my belief that most of the hæmaturias that were formerly considered the result of emptying an overdistended bladder too quickly, the so-called bleedings "*ex vacuo*," are not of bladder origin, and are not due to diminished intravesical tension, but that they are of renal origin and caused by an ascending infection and the resulting congestion.

These aseptic cases with overdistended bladders and serious renal embarrassment, the result of back pressure, will often present relatively few urinary symptoms. There may be some frequency, or there may be some incontinence, but as a rule the urinary symptoms are not the ones that lead these patients to seek relief. The symptoms referred to digestion are perhaps the most prominent: lack of appetite, causeless nausea and vomiting, a coated or dry tongue and the bad taste that so often accompanies this. There may be a considerable loss of weight, and involuntary twitchings are sometimes present.

The blood pressure will not be high, except in cases where there is an arteriosclerotic element in the kidney. This I have seen a few times. There will be polyuria. The urine will be low in gravity and low in solids. Such symptoms should lead us to suspect an overdistended bladder that is causing renal embarrassment by back pressure, and I believe it is much wiser in such cases to estimate the amount of residual by palpation than by the casual introduction of a catheter.

The prognosis in these cases, which depends upon the renal efficiency, is a difficult matter to determine, much more

difficult than it is, for instance, in an interstitial nephritis or an ordinary renal suppuration. I do not believe that as yet we have any means of estimating it accurately. It is a question, not only of estimating the renal function at the time, but of making an allowance for the diminution of function that is going to result from the almost certain infection that will follow drainage, whether this be by regular catheterization, retention catheter or suprapubic cystotomy. It is impossible to estimate this further crippling of function with accuracy.

I have seen several patients with aseptic back pressure, due to an overdistended bladder, who survived prostatectomy but died some weeks or months later as a result of a progression of the renal infection that took place at the time of operation. In such of these cases as have come to autopsy there has been a marked dilatation of the ureter and kidney pelvis; they have been atonic to a degree where they were unable to rid themselves of the infection, which progressed steadily until the patient succumbed to renal insufficiency. In order to make an accurate prognosis we would have to determine the extent to which the suppuration would extend, a manifest impossibility.

In the treatment of these cases our object is twofold. We wish to get the relief that the removal of the back pressure brings about and to get it with as little infection as possible.

The treatment of the two reported cases was not successful, and I believe could have been improved upon. It would probably have been wiser to have opened the first man's bladder, either at the time I first saw him, or at the time he had gotten the benefit that came from relieving his back pressure, about the twelfth day, before the infection had involved his kidneys. In this way I should have made a more intelligent attempt at limiting his infection, in that I should have avoided the occasional backing up of septic urine that took place. This backing up comes in most patients with atonic bladders whom one attempts to drain with an inlying catheter.

In the second case I should have spared the patient the shock of ether. This man had not had the benefit of the relief of his back pressure that would have come from constant drainage; he had, however, the sepsis that follows instrumentation in such cases, and it is doubtful if any plan would have succeeded with him.

While one sees patients of this sort who can bear a little ether and others who can bear some infection, we cannot be sure that any given patient can. I have come to feel that in patients of this sort we should do our utmost to spare the kidneys both the injury of ether and of infection. I believe this is best accomplished by a preliminary cystotomy under local cocaine anæsthesia. This is not always an easy operation for either the patient or the operator, yet it gives the greatest assurance we can offer against infected urine in the bladder under pressure.

Within the past few months I have seen at least three cases of this sort in which a preliminary opening of the bladder under cocaine has allowed a patient, with seriously embarrassed kidneys, apparently bordering on uræmia, to regain his renal function to a degree that made successful operation for the removal of a urinary obstruction possible in two cases. The third, the patient of another man, had not come to operation the last I knew. An objection perhaps to this preliminary suprapubic drainage is the fact that it practically commits us to suprapubic prostatectomy later.

I wish now to report briefly two infected cases with back pressure.

Case III. This patient, seen in April, 1911, was 63 years old. No venereal history. About four years before he first noticed difficulty in passing urine, but no frequency and no pain. For six months he had had to urinate three or four times at night, and had had a little pain at the time of urination. He passed a little blood about a year before. His chief trouble was "indigestion," dizziness and loss of strength. No cardiac lesion could be found; his blood pressure was 130

mm. Hg. His urine, which was passed in a poor stream, was turbid with a moderate sediment made up of pus cells and bacteria. Urine acid, specific gravity 1008, urea 1.64%, a moderate trace of albumin. By abdomen a considerably distended bladder could be made out; by rectum a small fibrous prostate with a soft, full bladder, bulging down behind.

He was sent into a hospital. Twenty ounces of residual urine were found, and a retention catheter tied in. In four days, under forced fluids, the specific gravity had risen to 1016, the urea to 2.40%. This in spite of the fact that he had had a flare-up of his pyelonephritis and his albumin had gone up from a moderate trace to one *per mille*, by Esbach. On the eighth day his time of appearance for phthalein had come down to ten minutes; on entrance it had been twenty-five minutes.

On the ninth day this patient had a suprapubic prostatectomy under ether and made a good recovery. When last seen, about six months after operation, this man's urine showed that his pyelonephritis still persisted, but he was having no subjective symptoms from it. His symptoms of renal insufficiency had disappeared.

Case IV. This man, seen in January, 1912, was 63 years old. Urinary symptoms began with frequency about seven years before. This has increased steadily, and for some time he has had pain in his right loin. A month before, he had an attack of grippe, since which time his frequency has been greater and his pain more severe. He has also had digestive distress and had lost about twenty pounds in weight. Makes very frequent attempts to pass urine at night and rarely accomplishes anything, but as soon as he goes to sleep his urine dribbles.

Rectal examination shows no increase in size of prostate, but the bladder bulges down behind it. By abdomen the bladder can be felt midway between the pubes and umbilicus. Tenderness in right loin, but no mass. Blood pressure 126 mm. Hg. Heart negative, pulse 96. A dry parrot-like

tongue. Urine acid, specific gravity 1012, urea 1.39%, a slight trace of albumin but no sugar. Sediment heavy and made up of pus and bacteria. Patient is very feeble and is apparently on the border of uræmia.

An attempt was made to withdraw his residual gradually with a retention catheter, but the patient would become confused at night and remove it. Pain appeared in his left loin as well as his right. Urine bloody, light in gravity and with an increased amount of albumin, three *per mille* by Esbach. Pulse intermittent. Six days after admission suprapubic cystotomy under cocaine anæsthesia. Six days after cystotomy urine 106 ounces, specific gravity 1009, urea 1.45%. General condition improved. Eighteen days after suprapubic drainage an obstructing bar at the bladder outlet was cut away under spinal anæsthesia. Patient made a good recovery and at the time of leaving the hospital had no pain, no dribbling. His tongue was moist.

These patients present much less difficulty than those of the aseptic type. In the first place, an examination of the urine will show at once that they have kidney involvement. This is indicated by the amount of albumin present rather than by the finding of casts. One seldom finds casts in these renal suppurations, though they are probably present. An amount of albumin that is as great as one-half *per mille,* I believe always means involvement of the kidneys, no matter how great the amount of pus, and one may reasonably suspect renal involvement with much less albumin, even when the urine is loaded with pus.

In patients of this type we have less fear of infecting a soil that is especially favorable. The infection has already taken place and the patient has developed a considerable immunity to it. Consequently all we need consider is the question of relief of the back pressure. Our tests for renal efficiency here are of considerable value, and we may fairly assume that the potential kidney power is greater than that

indicated by these tests, for with the relief of the back pressure we shall get a considerable increase in renal efficiency. This was well shown in Case III, when catheter drainage worked well and the delay of appearance of phthalein diminished from twenty-five minutes to ten minutes in eight days.

In the greater number of these cases the use of a retention catheter will be all that is necessary to relieve the back pressure and bring about improvement. In a few cases, however, as in Case IV, when drainage by catheter is not successful, suprapubic cystotomy under local anæsthesia should be substituted.

In conclusion: I believe that the mortality in operations for the relief of prostatic obstruction depends largely on the condition of the kidneys; that urinary back pressure and the damage and embarrassment this inflicts on the kidneys is the commonest form of renal danger in prostatics. Its importance lies in the fact that a patient may be very near the uræmic state without this being evident. Our functional tests do not give us absolutely definite information as to how near the uræmic state a patient is. We get our most accurate idea of this from the symptoms of general toxæmia that these patients show; they are referred to the digestive tract most often, less frequently to the nervous system.

What I term the "element of embarrassment" in these patients, the element that depends on back pressure alone, is capable of relief. This element that is capable of relief by proper preliminary treatment may be enough to determine the success or failure of operation.

Our endeavor in these patients should be to relieve the back pressure without infecting the urinary tract or with the minimum of infection. In the aseptic cases this is best accomplished by a preliminary suprapubic cystotomy under local anæsthesia; in the infected cases an inlying catheter is usually sufficient.

DISCUSSION

DR. EDWARD L. KEYES, JR., of New York: I cannot add anything to what Dr. Chute has said. I should like for my own part to insist upon two points that have struck me as of importance in guiding one's method of action in these cases.

In the first place, I was long ago taught by my father to have a horror of the prostatic with polyuria, and my own experience has only served to enforce that feeling, that among all the bad symptoms which prostatics manage to exhibit, one of the very worst and one that is the most easy to overlook, is marked polyuria, which was so noticeable in several, if not in all, of the cases mentioned by Dr. Chute.

In the second place, it has been my own impression from a somewhat limited experience that the palliative operations, as one might call them, of mechanical and local sort for the purpose of relieving back-pressure, may be classed in this order: intermittent and regular aseptic catheterization, the indwelling catheter, the suprapubic section, in precisely the same order as Dr. Chute names them, and I think with an increasing advantage for each one of the list; that is to say, that the indwelling catheter works better than the intermittent catheterization, and that a suprapubic cystotomy works better than the indwelling catheter, with this one exception, that for many patients the suprapubic cystotomy implies rest in bed, and for the worst of these cases rest in bed, I think, is the one thing that implies rapid failure of force and death.

DR. G. S. WHITESIDE, of Portland: I prefer perineal drainage to suprapubic. It seems to me that water runs down hill better than up hill.

DR. R. F. O'NEIL, of Boston: Some years ago I had one of these aseptic cases of pyelonephritis secondary to a prostate with an enormously distended bladder. The patient suffered a good deal from frequency. I put in an indwelling catheter and had a certain amount of urine drawn every couple of hours, and at the end of two or three days the bladder remained empty. On one occasion the clamp slipped off the catheter and the bladder became empty all at once, causing a good deal of spasm and some hæmorrhage. This was relieved with morphia and replacing some boric solution in the bladder. The urine had become cloudy, so I did a suprapubic cystotomy under cocaine and found considerable intravesical enlargement of the prostate. After a few more days I did a suprapubic prostatectomy under gas-oxygen anæsthesia. The patient was up a few days after the operation and doing well, but on the tenth

day he became very ill with nausea and vomiting. He stayed in the hospital for two months and finally recovered sufficiently to return home. The bladder, however, was unable to take up its function entirely, he having a residual varying from 12 to 20 ounces and used a catheter once or twice a day. He died four or five months after the operation. Autopsy showed a pair of kidneys so damaged that I do not see how he lived at all.

DR. H. A. FOWLER, of Washington: This is a most excellent paper of Dr. Chute's, and about the only way to discuss it is either to emphasize the points that he has already touched upon or to relate our personal experience in these cases, and in this connection I want to speak very briefly of a recent case, in many respects very similar to the first two which the doctor reported.

This man, aged 71, consulted me for dribbling. He dribbled by night and he dribbled by day. He was wearing a rubber urinal. The bladder was tremendously distended, and he was suffering from severe abdominal pain. He was unable to void at all, and the urine dribbled away into the urinal. A catheter was passed, and 1150 cubic centimeters of residual urine were withdrawn at once—and I want to say in this connection that it has not been my experience to see hæmorrhage follow the emptying of an overdistended bladder at once by catheter. That was a thing that I was taught and a thing I have looked for, but fortunately I have never encountered it, although I have seen cases where there was great ease in passing the catheter the first time when subsequently the passing of the catheter was extremely difficult on account of the swelling of the tissues in the prostatic urethra. This man was extremely ill. His urine was clear like water. A large amount was passed during the twenty-four hours, which was relieved by catheter. He was emaciated, he had digestive troubles, and it was for this he had been treated previous to his coming under observation. He had been unable to eat practically anything for two or three months; he had almost a total absence of appetite. Under regular catheterization his condition improved considerably. He was sent to the hospital and was catheterized regularly for three weeks. At the end of this time there was a marked improvement in his condition, as shown by the results of the functional test with phthalein. When he first came under observation the time of appearance was markedly delayed, and the excretion of phthalein was very low. At the end of three weeks of preliminary treatment the time of appearance was cut

about in two, and the amount of excretion during the first hour was markedly increased. On the basis, then, of his improved physical condition and the apparent improved condition of his kidneys, as disclosed by the functional test, we felt justified in going ahead and doing a prostatectomy. His prostate, by the way, was not palpable per rectum. It was entirely an intravesical projection of the prostate, and not very large, as we often find in these cases; the size of the prostate has no relation to the amount of residual urine. A suprapubic prostatectomy was done under gas-oxygen anæsthesia, and the subsequent history of the patient is that his bladder function at the present time is quite normal, and he has regained his lost weight. The man is completely changed physically. From a very ill and emaciated patient, he is now vigorous for his age, and his bladder function is normal. We all like to report our favorable cases.

Dr. Chute: Dr. Keyes' points that those men must be kept in bed after cystotomy: I do not think it is necessarily so. I do not keep them in bed. If I do the operation in the morning I have them sit up that afternoon.

I wish Dr. Fowler had told us how he prevented these people from getting infected. He apparently did, and he evidently is going to keep the secret. I wish someone would tell me how you are going to catheterize aseptically.

RETENTION WITHOUT MECHANICAL OBSTRUCTION AND WITHOUT DEMONSTRABLE LESION OF THE NERVOUS SYSTEM

By H. A. Fowler, M. D., of Washington, D. C.

THERE has been under my care during the past year a patient suffering with chronic partial vesical retention. For this condition no adequate cause can be found. There is absolutely no mechanical obstruction to urination, a fact which has been established by repeated careful cystoscopy and urethroscopy. He presents no signs or symptoms of tabes dorsalis or other cord lesion, and a careful neurological examination fails to show any evidence of this condition.

In the absence of mechanical obstruction or cord lesion the etiology of the retention is difficult to explain. This case has been studied with considerable care, and as it presents some points of unusual interest the history will be reported in some detail.

L. J. B., aged 48 years, printer, was first seen September 12th, 1910, complaining of incontinence of urine. He has been an unusually healthy man. He denies absolutely any venereal infection. He has four healthy children. His wife had no miscarriages.

Six years ago he first noticed a slowness in starting his urine. He consulted a physician who passed a sound and claimed to have "broken an obstruction," which was followed by slight bleeding, but the condition remained the same. At times he felt as though the bladder was not emptied and he would strain to pass more urine. He had to wait for the urine to start and to use force in expelling it. This condition has persisted to the present time. There has never been any pain associated with urination and at first he did not have to get up at night to void. In December, 1909, he began to have involuntary escape of urine at night. At first slight, this has gradually and continually grown worse until at present the leakage is abundant and does not waken him. Although he gets up three and four times during the night the bedding is soaked every morning. Recently the urine escapes frequently during the day, particularly on coughing or slight muscular exertion. This necessitates his wearing a napkin, but in spite of this his clothing becomes saturated, the odor is strong, and he fears he will have to give up his work as he cannot associate with his fellows. The incontinence during the day is much worse when sitting with the feet elevated or thighs flexed. He has been treated with belladonna, urotropin, and sounds have been used, all without benefit.

Examination. A thin, spare built man, healthy in appearance. External genitalia normal. There are no scars on the penis or over the body. The urine is clear, very light in color,

acid, specific gravity 1014, no albumin and no sugar. Microscopic examination negative. The prostate is normal in size and consistence. The vesicles are soft and cystic, evidently distended with secretion. Both the prostate and vesicles are bulging into the rectum as though pushed down by a distended bladder. During rectal examination a considerable amount of urine escaped involuntarily, and following the examination he voided 75 c. c. although he had just emptied his bladder as completely as possible. The prostate secretion contained a considerable amount of pus and active spermatozoa.

Cystoscopy 9-13-'10. The patient first emptied his bladder as completely as possible. A catheter was passed and 180 c. c. of residual urine were withdrawn. In washing out the bladder through the catheter it was noted that not more than 100 c. c. of the irrigating solution would run into the bladder before the latter would contract and forcibly expel its contents around the catheter. In other words the bladder was hypersensitive to the irrigating solution just as one sees in acute inflammation, for example. The catheter and cystoscope passed very easily. Trabeculation was marked over the entire bladder except the trigone. The trabeculæ were fine and delicate and formed a veritable network of interlacing muscle bundles with shallow interspaces. These were much finer and more delicate than one sees in cases of prostatic hypertrophy, for example. The mucosa appeared normal. There was no intravesical projection of the prostate laterally and no middle lobe or bar present. Rectal examination with the cystoscope in the bladder showed no increase in prostatic tissue.

On account of the prostatitis the patient was put on regular prostatic massage. As a result his condition appeared to be greatly improved; the incontinence was so far controlled that only occasionally he wet his bed, while during the day he had complete control. At times he would have marked frequency of urination, lasting two or three hours and then subsiding. On November 6th a third cystoscopy was performed. At this time there was 150 c. c. residual urine. The

bladder capacity at this time was 200 c. c. With this amount of distention the examination was more satisfactory. The same bladder condition was noted as at the first examination. In examining the urethral orifice the Nitze examining cystoscope could be withdrawn into the prostatic urethra and a beautiful view of the latter obtained. The mucous membrane could be followed from the prostatic urethra over the sphincter vesicæ and back over the trigone. The view was most striking and similar to that obtained with a close vision instrument. In other words, the prostatic urethra formed a pouch distended with the irrigating solution, continuous with the bladder and separated from it by the relaxed vesical sphincter which formed a ring or window separating the two cavities.

The patient was referred to Dr. Tom Williams for a neurological examination. He reported the tendo-Achilles reflex absent, Romberg's sign present on one side. Otherwise the examination was negative. A Noguchi test was also negative. He was under treatment for about six months. During this time there seemed to be some improvement in his condition: the incontinence was not so marked, though it never entirely cleared up. The amount of residual urine was not constant, but varied from time to time. Occasionally he emptied his bladder completely. Another interesting feature was noted: he would void as much as possible, then after prostatic massage he would pass a considerable quantity of urine, and then a catheter would withdraw a further quantity of residual urine. An accurate record of these amounts was kept, which varied from 50 c. c. to 150 c. c.

I have recently examined this patient after an interval of several months during which time he has been treated by another physician with electricity. At the time of this examination he had residual urine amounting to 200 c. c. The prostatic secretion contained considerable pus. While under treatment by prostatic massage his incontinence was almost completely controlled, but never entirely so. During the past

few months his condition has remained practically the same. This is very much better than it was when he first came under observation in that he has much better control of his urine, but at times he dribbles considerably. The amount of residual urine has remained about the same.

In the paper by Albarran and Noguès before the first Congress of the International Association of Urology the subject of retention without mechanical obstruction and without lesion of the nervous system is reviewed at length. In this comprehensive report the authors divide these cases into three groups as follows:

1. Retention with insufficient obstruction.
2. Retention without obstruction and without known vesical lesion.
3. Retention without obstruction, but with vesical lesions.

In group 1 belong those cases in which a local lesion exists, such, for example, as slight prostatic hypertrophy, hypertrophic prostatitis, stricture of large caliber, etc., but which is not sufficient to account for the retention. In other words the retention is out of proportion to the degree of obstruction.

In the second group belong those cases of retention observed in the course of acute and chronic intoxications, acute and chronic infections, and functional disturbances of the bladder and sphincters.

In the third group are included those cases which present vesical lesions only, such as the degenerative changes of the bladder wall, and cystitis, acute and chronic.

That all cases of retention without mechanical obstruction and without demonstrable lesions of the nervous system cannot be included in this comprehensive classification is a fact recognized by the authors. And they report two cases, both young men, in which no cause whatever for the retention could be found. A third patient, a man 60 years of age, presented all the symptoms of a prostatic, but the minutest

examination failed to show any trouble with the prostate or any organic nerve lesion. A perineal prostatectomy was done, however, and the excised gland was found normal. The patient recovered from the operation but his condition was unimproved.

Thompson Walker has reported an interesting series of cases of retention without mechanical obstruction and without organic disease of the nervous system. Several of his patients were young men. Cystoscopic examination showed a markedly trabeculated bladder of the type so often seen in tabes. Walker believes that tabes can be definitely excluded in his cases. He calls attention to the fact that there is experimental evidence to show that the lowest vesical center is in the hypogastric plexus. And he suggests that the retention in these cases is due to a lesion limited to the hypogastric plexus and involving this lowest vesical center. This explanation appears to be a very plausible one and fits in with the observed clinical facts. However, the nature and pathology of such a lesion remain unexplained. The suggestion is a valuable one and it is to be hoped that further work will prove the truth or fallacy of this hypothesis.

In our own case there is no mechanical obstruction to urination. The bladder shows to a marked degree the changes, trabeculation, which one sees so often in cases of retention due to the interference with the nerve control of the bladder. It is to be noted further that, as in tabes, the amount of residual urine is not constant, but varies from time to time. I believe, however, that we are justified in excluding tabes in our case for the reason that there are no other signs or symptoms of this disease, and that one would expect in six years other evidence of the disease to appear.

It scarcely seems probable that the chronic prostatitis present in our case is sufficient to account for the retention. Aside from the retention there are no other symptoms referable to the prostate. It does not appear probable that the theory of inhibition proposed by Albarran is applicable in this case.

DISCUSSION

DR. FRANCIS R. HAGNER, of Washington: I would like to ask Dr. Fowler one or two questions. In the first place, about the patient's bowels, whether he had any chronic constipation or any difficulty in having movements? The second question is as regards the posterior urethra, whether the column of fluid in the bladder came down to the cut-off muscle and dilated the posterior urethra?

I had a case somewhat similar to the one Dr. Fowler reports, but it followed a bullet wound. This boy, when he was 12 years old, was shot accidentally with a rifle, the bullet entering the abdomen, and he had these fine trabeculæ, a large amount of residual urine, chronic cystitis, and all the symptoms going with bladder infection and residual urine. The picture on cystoscopy was like that seen in locomotor ataxia. You could cystoscope the whole posterior urethra. The column of fluid rested against the cut-off muscle. This patient had rectal incontinence as well as vesical.

DR. JOHN T. GERAGHTY, of Baltimore: Recently I had the opportunity of examining the pathological material in a number of Dr. Young's cases in which he had done his punch operation in cases of obstruction without enlargement of the prostate. In practically all of them the lesion was a fibrosis. There was an inflammatory infiltration in many of them which extended down to the sphincter muscle, replacing often large bundles of the latter, so that the thing could be looked upon in a large proportion of cases as really a contracture of the internal orifice. In one case the process was evidently from the prostate primarily, with the mucous membrane and submucosa entirely normal. The fibrosis was in the prostate itself, and formed a complete fibrous ring around the vesical neck. So that here the inflammatory process is not in the prostate itself. In all of those cases the submucosa and mucous membrane were involved. In one or two cases there was nothing to account for the obstruction, although removal of the tissue with the punch gave relief. In these few cases there was nothing present except hypertrophy of the submucous glands. As you know, there are a number of glands which lie beneath the mucosa between the sphincter muscle and the submucosa, the so-called cervical group of glands of Albarran. In one case that we had a prostatectomy had been done, and subsequently the punch operation was done, with no relief of symptoms. The subsequent history of the case is rather interesting, in that he has recently

developed a severe condition of Raynaud's disease. In the vast majority of the cases, although in many there was nothing to be made out with the cystoscope, the obstruction was due to a definite fibrosis of the internal orifice.

Dr. Ramon Guiteras, of New York: I would like to call attention to the fact that residual urine is sometimes due to external causes; that is, causes outside of the bladder. I had one case in which the trouble was due to adhesions of the omentum to the top of the bladder, the transverse colon being very loose, and being within about two inches of the bladder wall. On separating the adhesions and removing pieces of the omentum, the transverse colon immediately went upward, the bladder was released, and the symptoms were relieved.

In women very frequently there are adhesions of the tubes, of the sigmoid, or of the omentum, to the bladder. Sometimes a piece of sigmoid will be held down against the bladder, giving rise to complete retention, and there are a great many conditions in women especially that are due to extravesical causes.

What Dr. Geraghty has just spoken of we all see occasionally in doing stricture operations. I suppose we all put our fingers through our perineal wound in perineal section, into the bladder after operation, before inserting the perineal drainage tube, and sometimes we find we can just about get our little finger in, and find that it has a fibrous feel, and we have to dilate it before we can put our large perineal tube in. This is very marked. I see no reason why it should not give rise to some obstruction. It could also take place from tuberculosis and inflammatory lesions.

Dr. Fowler: In reference to Dr. Hagner's remarks, I might say that this patient did suffer from constipation, but that he did not have an incontinence of fæces, as one might expect if he had tabes. The point that Dr. Hagner asked about is one of the most important points in the case, which I really wanted to speak of, and that is the fact that when I first cystoscoped him the capacity of the bladder was small. Although we had withdrawn 150 c. c. of residual urine, yet the bladder was hypersensitive, so that we could only get in 100 c. c. of irrigating solution before the bladder would contract and expel the fluid from the bladder, around the catheter. At a later date, after prostatic massage regularly for several weeks, the bladder tolerance was increased for the irrigation solution, so that we were able to get a larger distention. It was at this time that we observed through the cystoscope that with the ordinary

Nitze cystoscope we were able to cystoscope the bladder and then draw the cystoscope out into the prostatic urethra, which was also dilated with our irrigating solution, and get a perfectly beautiful view of the prostatic urethra. The prostatic urethra formed a pouch distended by the irrigation fluid, communicating with the bladder through a window formed by the vesical sphincter, and this window was dilated. It seems to me that that rules out the possibility of a fibrosis, because one could see the size of the window increase and decrease with the contraction of the bladder sphincter.

As to any extravesical condition as the cause of the retention, I think that can be ruled out, because the patient had absolutely no other symptom than the hypersensitive condition of the bladder, which resulted in the frequent urination at times.

EXPERIMENTAL STUDIES OF THE ACTION OF ELECTRICAL CAUTERIZATION ON NEOPLASMS

By J. Bentley Squier, M. D., of New York

INDICATIONS for the use and the therapeutic value of the Oudin high frequency current, in the treatment of benign papillomata of the bladder have been established.

The studies which form the basis of this communication, have to deal with the action of the Oudin or monopolar, and the D'Arsonval or bipolar current upon malignant growths of the bladder and otherwise.

The work was undertaken in consequence of an unusual experience, where the use of the D'Arsonval current caused the disappearance of an extensive vesical carcinoma. The details of which are as follows:

A gentleman, 50 years of age, consulted me on February 4, 1912. One year previously, while in good health, frequency of urination had developed. Shortly afterwards blood appeared in the urine associated with dysuria. The hæmaturia, intermittent at first, became continuous. In December, 1911, he placed himself under the care of an able urologist, who performed cystoscopy and discovered a large tumor occupy-

ing the right side of the bladder. This surgeon suspected malignancy, but decided to apply cystoscopic fulguration, if only to check the profuse hæmaturia.

A number of attempts were made, but the excessive bleeding so interfered with the application of this treatment, that it was discontinued.

Shortly after this the patient came under my care. He had now become greatly debilitated from the continuous loss of blood. He was voiding urine the color of mahogany and operation was decided upon, if only to stop the bleeding from the bladder.

To digress a moment, sometime before in conversation with Dr. J. F. McCarthy, instructor in my department at the New York Post-Graduate Medical School, he had suggested the use of the D'Arsonval or bipolar electrical spark as a means for checking hæmorrhage in such a case, and the possibility of obtaining a more deep seated action upon the tumor than with Oudin spark.

It appeared that here was a justifiable opportunity to put the suggestion to the test. On February 6th, under ether anæsthesia, the bladder was opened suprapubically. The fundus was found to be widely involved by a growth, as was also the trigone in the region of the ureteral openings. The growth seemed limited to the mucous membrane in the fundal involvement, while in the trigone the deeper structures were invaded. The prostate was not involved.

The mass of tumor occupying the trigone was shelled out and the more superficial growth of the fundus curetted down to the bladder muscle. The bipolar spark was then applied to the interior of the bladder wherever any growth had been.

The technique of its administration consisted in placing the patient in a high Trendelenburg position, exposing the interior of the bladder with wide retractors, and illuminating it by a tantalum lamp. One electrode, a large flat plate was placed beneath the buttocks and the spark was produced by

inserting the other electrode, a cystoscopic fulguration wire, into the bladder through the suprapubic opening.

All hæmorrhage at once ceased upon application of the spark. The bladder and suprapubic wounds were closed around tubular drains. Considering the condition of the patient before operation, it was remarked how well he had stood the operation.

Histological Examination of the Tumor

Microscopic examination shows two types of carcinoma—one in which there are small alveoli of carcinoma cells, and the other, the predominating type, in which there are papillary tufts clothed with a mass of cells of the cylindrical and flattened varieties.

Diagnosis: Papillary carcinoma.

The post operative period developed many interesting features. Six hours after operation, the drainage tube becoming occluded, the patient passed by urethra urine absolutely free from blood. This was the first time for over six months that hæmaturia had been absent. Convalescence progressed favorably and at the end of five weeks the abdominal wounds were healed. He was passing urine free from blood and there had been no return of the hæmaturia since operation.

Seven weeks after operation sudden death occurred from pulmonary embolism.

The bladder was removed after death and sent to the pathologist for serial section and minute study. There was no macroscopical evidence of carcinoma either in the fundus or trigone.

Histological reports on the removed bladder are here given in full:

Specimen: Bladder. Examination reported March 25, 1912.

Microscopic examination: Certain portions of the bladder wall show total absence of mucous membrane, the submucous

coat being very rich in vessels, and being diffusely inflamed. Evidently there has been some post mortem degeneration, for the tissue takes the stain poorly.

Other sections show inflammatory involvement of fat and of the serous coat; total absence of the mucosa, the submucosa being necrotic. Still other sections which are better preserved, also are devoid of mucous membrane, there being a very vascular submucosa with evidence of chronic inflammation.

A portion of the bladder wall, in all probability taken from the region of the sphincter of the prostatic urethra, shows intense post mortem desquamation of cells, marked atheroma, calcification and endarteritis of some of the larger vessels. There are islands of cells of probably desquamated epithelium (not neoplastic).

No definite evidence of carcinoma.

Examination reported: March 27, 1912.

Further study of sections from bladder shows marked necrosis of the inner vesical layers. Inflammation without any trace of carcinoma.

Examination reported: April 1, 1912.

Further material from bladder specimen: microscopic examination of the wall of the bladder shows extensive necrosis of the submucous layers, absence of the mucous and marked inflammation of the submucous coat.

There is no vestige or slightest evidence of the presence of carcinoma.

A few days before operating upon the patient whose history has just been related, I had opened a patient's bladder for carcinoma, instituting suprapubic drainage but making no effort to remove the tumor.

Believing that I now had at least a sure means for controlling hæmorrhage, I offered to make an attempt to remove the tumor, to which the patient acquiesced.

This patient was 65 years of age, the hæmaturia although

having been present for eight months had not produced so grave an anæmia as in the preceding case.

The second operation was performed on February 8th and a tumor about two by three inches in size excised. It was situated around the left ureteral opening extending up the fundus. The lower end of the ureter was firmly attached to the tumor and it was necessary to cut the ureter away from the tumor and transplant it.

The cavity remaining after excision of the tumor was thoroughly cauterized by the bipolar spark.

The patient recovered from operation without incident and the post operative period was free from hæmaturia. Up to the time of his death, three months later, when he succumbed to a rapid growing carcinosis, he had had no recurrence of hæmaturia. The recurrence of carcinoma was in the intestines, omentum and liver.

This method of treatment has been employed in five other instances: a large papilloma was removed by suprapubic incision and the base sparked; two cases of prostatic carcinoma, in which the cavities made by removal of the prostates have been cauterized by sparking; two cases of vesical carcinoma have been sparked through suprapubic incision, without any attempt at excision.

These cases are too recent to draw any conclusion from but will be reported in a further communication. In all these cases, however, one is impressed by the absence of any amount of bleeding after operation, and by the comparative small shock shown by the patient, even though in certain instances they have been subjected to a very considerable period of anæsthesia.

The experimental work on animals has been conducted at the laboratory of Dr. Francis Carter Wood, Director of the Crocker Cancer Research, who placed his facilities at my disposal.

The following is a brief abstract of some features of the investigation.

The experiments have been carried out on tumor-bearing large white rats, and though the series is still incomplete the results are suggestive. The rats have been inoculated subcutaneously with either a carcinoma of high virulence or a sarcoma. Both of these tumors as a result of repeated transfers are now so virulent for rats that practically all inoculations are successful.

The first series consisted of five animals, of which two had sarcomatous tumors, one measuring 1.5 cm. in diameter. These tumors were also loose in the subcutaneous tissue and could be freely moved about. The tumors were thoroughly fulgurated with bipolar electrodes, the distance between the poles being the diameter of the tumor. In two cases the current burned a hole in the skin and the tumor was loosened from the surrounding tissues and fell out. This material when examined microscopically did not show any evidence of extensive alteration; the staining qualities of the cells were merely somewhat less marked than in normal tissues. This seems that the cells were not much burned, but merely heated sufficient to coagulate the proteid. All of this series of five animals died in from one to seven days. In all remnants of neoplasm could be found at the original site of the tumor. Death was not due to extension of the tumor; the lesion found was an acute enterocolitis resembling those found after severe and extensive burns. The only conclusions which can be drawn from these experiments, therefore, are:

1. That the current is not entirely a harmless agent.
2. That it does not actually char the tissues very extensively.
3. That it does not touch extensions outside the field of the main growth.

In the second series six animals inoculated with carcinoma were used. Two of the tumors were large and ulcerating, the other four were small, not over 0.5 cm. in diameter. Five of the rats were treated with fulguration; in one the bipolar current was used. This last animal died a few minutes after

the cessation of the application of the current. Of the five remaining tumors four appeared to be actively growing, one appeared to be stationary at the end of twelve days. The infected surfaces of the two ulcerating tumors had become clean healthy granulations, though the tumors are extending.

It is evident from these experiments that neither the direct treatment with bipolar current nor fulguration of malignant new growths is capable of destroying all the carcinoma cells in a given area. While the use of the current is valuable in checking hæmorrhage, as in bladder operations, it can by no means be assumed to replace extensive resection in the cure of carcinoma. Its action is probably simply that of an easily handled cautery.

Further experiments are being carried on, detailed statement of which will appear in a later communication.

DISCUSSION

Dr. John T. Geraghty, of Baltimore: I would like to report a case that I operated on last summer, excising the tumor as thoroughly as possible with the actual cautery. Sections showed the lesion to be unmistakably malignant. The patient had a prompt recurrence, and I treated him with fulguration. In five treatments the areas of recurrence entirely disappeared. I cystoscoped him six months later, and his bladder was as smooth and clean as you could wish.

About three months ago I had a case in which the whole bladder was apparently a tumor formation. It seemed perfectly hopeless to attempt anything. I first intended only to do a suprapubic drainage, but decided to fulgurate him. We used the ordinary Oudin current with a long spark, and sparked the bladder for about forty minutes. The bladder was left wide open, and two weeks later we looked in and the lateral walls were completely free from any tumor. The posterior wall still had tumor. At the second operation the posterior bladder wall around the vesical orifice was sparked. I looked in a third time, and apparently the bladder was smooth except for some œdema and one small tumor mass on the anterior bladder wall. This tumor was apparently distinctly firm at the base, and sections of the tumor one would pronounce certainly a malignant papilloma.

So these two cases apparently were unquestionably malignant; at the same time the tumors seem to have disappeared.

Now as regards the nature of the action of the current on the tumor. I had one case with a tumor as large as my fist; the man had had hæmaturia a couple of years. It was possible to apply the current only to one side of this tumor. You could not get on the right hand side of it, and had to make your application to one side. Notwithstanding that, the tumor disappeared as a whole. It came down gradually, growing smaller and smaller, and finally disappeared, so that the action of the current was just the same on the part of the tumor not touched at all.

DR. SQUIER: I have nothing to add except that this is, of course a rather new way to handle malignant growths. I think it would be interesting to hear next year what our continued experience has been. The gynecologists claim that the only way they have at the present to combat cancer of the cervix and uterus is by the cautery. It may be that we have found something that will be of some aid in this extensive burning of the bladder.

Theses Presented by Candidates for Admission to the Association

THE EFFECTS OF LIGATION OF THE URETER; AN EXPERIMENTAL STUDY

By J. Dellinger Barney, M. D., of Boston

WHEN our standard text-books on genito-urinary surgery, written as most of them are " for the student and general practitioner," contain erroneous statements of fact, and " when doctors disagree," an effort to settle the question once and for all seems justifiable. Such is the situation in regard to the results of complete and sudden occlusion of the ureter.

From Keyes' " Genito-Urinary Diseases " we learn that:

" Sudden complete obstruction of the ureter occurs clinically under two forms, viz., by a calculus, and by the surgeon's ligature. In either event the result is the same. The urine is dammed back upon the kidney causing an acute renal congestion and a diminished secretion of urine; but even this increases the intrarenal pressure. The congestion is exchanged for atrophy."

Watson and Cunningham in their " Genito-Urinary Diseases " say:

" Complete, total, long-continued or permanent obstruction of the ureter does not cause hydronephrosis. In order to have it produced, the obstruction, if complete, must be repeated or short-lived. . . . "

" . . . total occlusion of the ureter, unless it be maintained for short periods only, and unless repeated, does not produce more than a very slight degree of distention of the renal pelvis and calices."

We are informed by Adami and Nicholls (Principles of Pathology) that:

" Obstruction to the outflow, leading to the accumulation of urine in the pelvis or pelvis and ureter, if complete, leads to atrophy of the affected kidney."

One of our greatest authorities, Morris, says in his " Surgical Diseases of the Kidney and Ureter " that:

" It has been demonstrated by observation and experiment that a sudden, complete stoppage of the outflow of urine leads to rapid atrophy and ultimate disappearance of the affected kidney."

That the opinions so forcibly expressed by these authors are shared by many surgeons has been the experience of the writer.

In order that there may be no misunderstanding of the term " hydronephrosis," and hence an argument beside the point, let us see what the word means.

In Gould's " Illustrated Medical Dictionary " it is thus defined:

" Hydronephrosis—a collection of urine in the pelvis of the kidney from obstructed outflow. The pressure of the fluid causes in time atrophy of the kidney structure and the whole organ is converted into a cyst."

Dorland's " American Illustrated Medical Dictionary " says:

" Hydronephrosis—a collection of urine in the pelvis of the kidney forming a cyst by distention and atrophy of the organ."

Morris, speaking of the historical aspect of this pathological entity says that in 1785 Martineau adopted the term " hydrops renis." In 1816 Johnson suggested " hydrorenal distention," but since the appearance of Rayer's " Traité des Maladies des Reins," in 1840, the term " hydronephrosis " has been generally accepted and used.

We are here speaking of the results of *complete and sudden* occlusion of the ureter similar to that produced by the surgeon's ligature. Occlusion by calculus is sudden, but rarely complete, or, if so, is of short duration, or intermittent;

PLATE IX. — Presented by Dr. J. Dellinger Barney

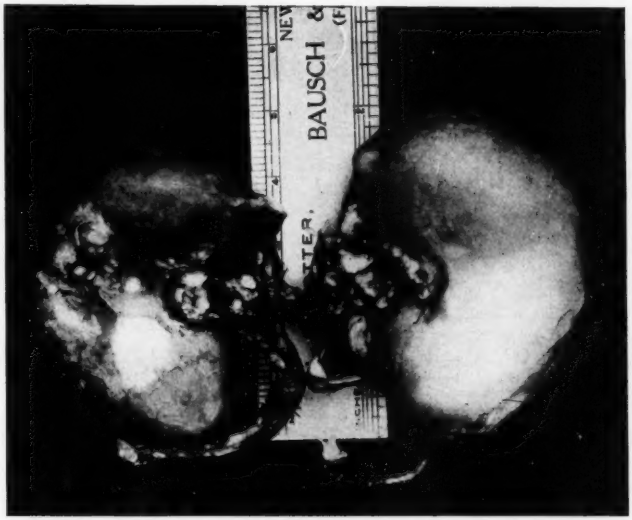


Fig. 1

Dog 5. Eighteen weeks. Ligature of right ureter. Atrophy of kidney without dilatation. Ureter very slightly dilated, not tortuous. No evidence of engorgement of capsular vessels.

while the obstruction caused by a cicatricial band or cancerous mass may be finally complete and permanent, but is of gradual onset. The results produced by these conditions are not now under discussion and will not be considered here. That they may result in hydronephrosis of greater size than that which is produced by the means described is not debated.

It is granted by all that atrophy of the renal tissue occurs in all hydronephroses. This is a necessary result of the condition, but there occurs a simultaneous distention of the renal sac, its size depending on the duration of the ureteral obstruction. Those who claim that this occlusion causes atrophy either overlook the accompanying distention of the renal sac, or what is more evident, they would have us believe that true atrophy of the organ occurs, an actual decrease in size owing to the cessation of renal function. That these premises are faulty, not only as to the condition of the kidney, but also as to its cessation of function, will be shown later. The writer acknowledges, however, that there are exceptions to this as to every rule. But these exceptions are not common, and in our opinion, are to be explained on a definite anatomical basis, later to be discussed.

One need only glance at the literature to find that it teems with investigations of the problem before us. That the results of the work of the experimentalists are generally in accord is clear. Clinical investigations and observations being less numerous, less accurate, and necessarily less thorough, opinions naturally differ. But that complete and sudden occlusion of the ureter by ligature causes hydronephrosis in man as well as in the lower animals we hope to show at another time.

Experimental ligation of the ureter by Lindemann, Sollmann, Williams and Briggs, Bainbridge, Gayet and Cavaillon, Amos, Cohnheim, Albarran and Legueu, Strauss and Germont, Arnould, Guyon, Rosow, Pearce, and the writer, has resulted in the production of hydronephrosis. Many others have reached the same conclusion.

It was stated above that there are exceptions to these findings. Thus, Lindemann, the leading investigator of this question, found simple atrophy in three out of six dogs whose ureter had been ligated. Others have occasionally found similar results.

In substantiation of his hypothesis that sudden, complete, and permanent obstruction of the ureter by ligature produces hydronephrosis, the writer submits the results of animal experimentation done by him during the past three years. This work was done in the Laboratory of Surgical Research at the Harvard Medical School. Advice and courtesy have been freely extended from the departments of pathology, bacteriology and physiology, and are here gratefully acknowledged.

Thirty-three animals were operated on, seven rabbits and twenty-six dogs. Dogs are preferable to rabbits for two reasons; first, the results are far more striking; second, the anatomy, especially of the blood vessels, and physiology of their genito-urinary system is more nearly like the human than that of any other animal. The rabbits and most of the dogs were operated upon solely for the sake of observing the effects of ureteral ligation. The remaining dogs were used for the study of other aspects of this problem, and these will be discussed at another time.

The operations were done with every precaution as to asepsis and the complete anæsthetization of the animals with ether. In many morphia was administered subcutaneously before etherization. The abdomen was shaved and the skin made sterile by the use of soap and water and tincture of iodine. A median incision extending upward two or three inches from the pubes gave ample exposure. The ureter was isolated at the pelvic brim by cutting or tearing through the peritoneum, and ligated at this point in two places with silk or with No. 1 chromic catgut. It was divided between the ligatures and the stumps replaced in their normal positions.

PLATE X. — Presented by DR. J. DELLINGER BARNEY

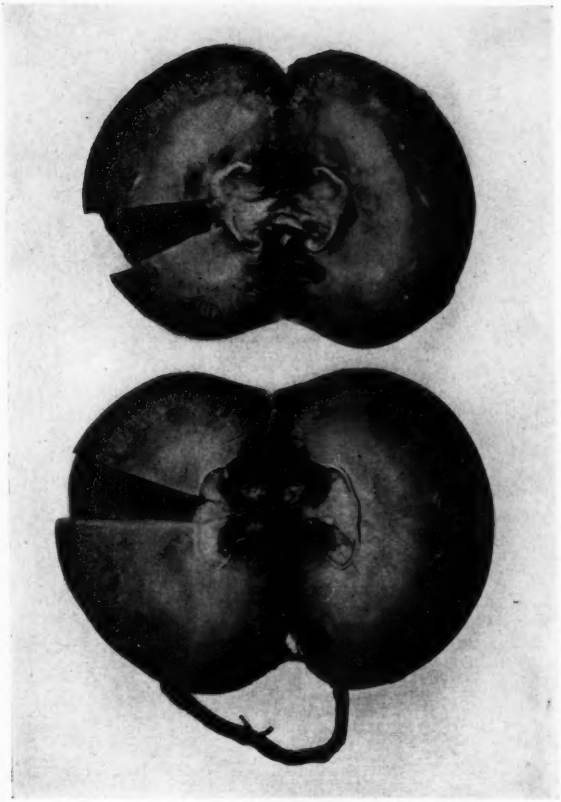


Fig. 2

Dog. 5. Eighteen weeks. Atrophied kidney above.

Note absence of dilatation of pelvis and obliteration of normal markings of kidney.

The abdominal wound was then closed with a continuous suture of silk or chromic catgut including peritoneum, muscle and fascia, and the skin with silk or silkwormgut. No dressing was applied and the animal was returned to its cage. About fifteen minutes was consumed by the operation.

Recovery was prompt and complete in every case. Those that became ill or died did so because of some later complication, such as sepsis (3 dogs), distemper (3 dogs), excessive heat (2 dogs), accident (1 dog), further operative interference (4 dogs). Two dogs died of unknown causes each three days after operation. The remainder were sacrificed, some by strychnia, others by hæmorrhage. There was no mortality among the rabbits. Others, such as Castaigne and Rathery, had a mortality among their rabbits of as much as 40%.

The length of time elapsing from operation to death was as follows:

Two days, 1; 3 days, 6; 5 days, 2; 7 days, 3; 11 days, 3; 14 days, 1; 15 days, 1; 20 days, 1; 24 days, 1; 25 days, 1; 28 days, 1; 29 days, 1; 30 days, 4; 42 days, 1; 56 days, 2; 61 days, 1; 126 days, 1; 247 days, 1; 258 days, 1; an average of 36.6 days.

In our experience the health of the animals was not in the least affected by the operation itself, barring those in which some complication developed later. In no case was there any evidence of pain, loss of appetite, or discomfort, either immediately after operation or at remote periods of time. A loss of weight has been observed by some investigators, notably Pearce, and again by Amos, but we have not seen it. All of the rabbits thrived and grew fat up to the time they were killed. This was also the case with the dogs, of whom two were carefully weighed for a considerable time before and after operation. These animals were kept in metabolism cages, were fed on measured amounts of the same food and water daily, and the daily weight was taken, thus:

Dog 13.

March 1 to 10, 1910.	In metabolism cage.	Daily meat, 200 gm.	Daily water, 500 cc.	Daily weight, 10½ lbs.
March 11, 1910.	Ureter ligated.			
March 11 to 18, 1910.	In metabolism cage.	Daily meat, 200 gm.	Daily water, 500 cc.	Daily weight, 10½ lbs.

Dog 15.

May 5 to 13, 1910.	In metabolism cage.	Daily meat, 200 gm.	Daily water, 500 cc.	Daily weight, 28½ lbs.
May 13, 1910.	Ureter ligated.			
May 13 to June 10, 1910.	In metabolism cage.	Daily meat, 200 gm.	Daily water, 500 cc.	Daily weight, 29 lbs.

It will be seen that whereas the weight of the first dog, observed for only eight days after operation, remained stationery, that of the second dog, weighed for a period of twenty-three days after operation, increased by half a pound. In both dogs, both before and after operation, the daily weight would fluctuate sometimes up to eight or ten ounces. From the general appearance of many of the other animals, whose weights were not recorded, the writer is convinced that the increase in weight after operation was even greater in some instances.

Another point carefully observed was the quantity and quality of the urine secreted by the sound kidney after ligation of the opposite ureter. It is natural to suppose that one kidney cannot and does not, for a time at any rate, secrete as much urine as two kidneys. But it is also fair to assume that the secretory power of the remaining sound kidney will increase to such an extent that the daily amount of urine will be the same essentially as before operation. A study of this point was therefore undertaken in the dogs mentioned above. As already stated, they were kept in metabolism cages for considerable periods of time both before and after operation, and the nature and amount of food and drink was kept uniform. Also, being in cages, the amount of exercise was small and varied but little from day to day. Although no claim is made that by this means the data collected are above criti-

A

B

Fig. 3

Dog 9. Five days. Hydronephrosis.

A. Right kidney somewhat larger than left; ureter tortuous, but not much dilated. Vessels of capsule moderately injected.

B. Section of hydronephrotic kidney shows slight dilatation of pelvis and pelvic outlet, and papillae not much atrophied.

PLATE XI. — Presented by DR. J. DELLINGER BARNEY

cism from an absolutely scientific viewpoint, they are believed to be accurate enough for practical purposes. The character and amount of urine before and after operation is shown in the accompanying table (Page 208).

It is thus seen that one healthy kidney can compensate in a remarkably short time for the loss of its mate as shown in Dog 13, a fact emphasized by Guyon, and by Cohnheim. The same holds true of Dog 15 in which the urinary output was essentially the same as that before operation. Throughout their life in the metabolism cages both dogs excreted urine in amounts varying daily widely and without apparent cause. At times the secretion dropped below 100 cc.; again it attained the high water mark of 590 cc. An important observation is that in no case, so far as known, did anuria occur from a reflex inhibition of the sound kidney (the reno-renal reflex of Guyon). As will be shown in a later communication this may occur in the human, but even here it is fortunately rare.

These results are also of interest in that they show a marked similarity in the character of the urine both before and after operation, but with a few points of difference. In Dog 13 the urine before operation was usually alkaline, while after operation it was usually acid. In Dog 15 a reversal of this reaction was noted.

The specific gravity shows the same reversal, for while in one dog it was higher after operation than before, in the second dog it was lower before than after operation.

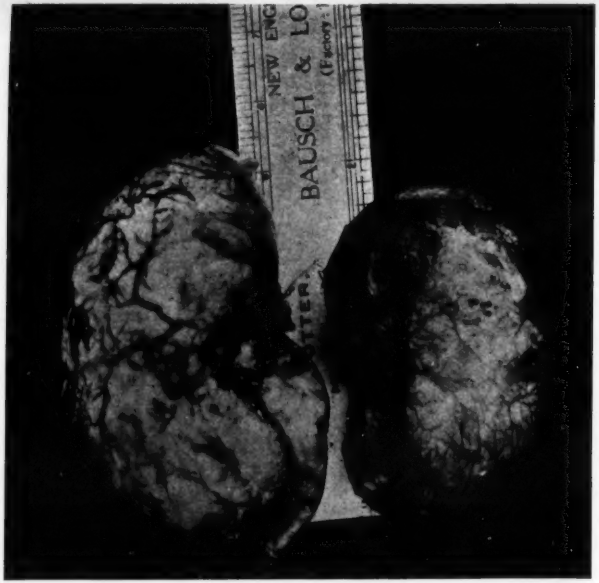
In both dogs the urea fell off in amount after operation; but whereas in Dog 13 the difference was slight, in Dog 15 its daily average was only a little more than half what it was before operation. The percentage, however, is still high, and as this dog and others lived in perfect health for many months, the excretion of metabolic waste was clearly sufficient. Cohnheim has also emphasized this point. The situation may be illustrated by a remark attributed to Abraham Lincoln. When asked how long a man's legs should be, he replied that "They should be long enough to reach to the ground." No

TABLE

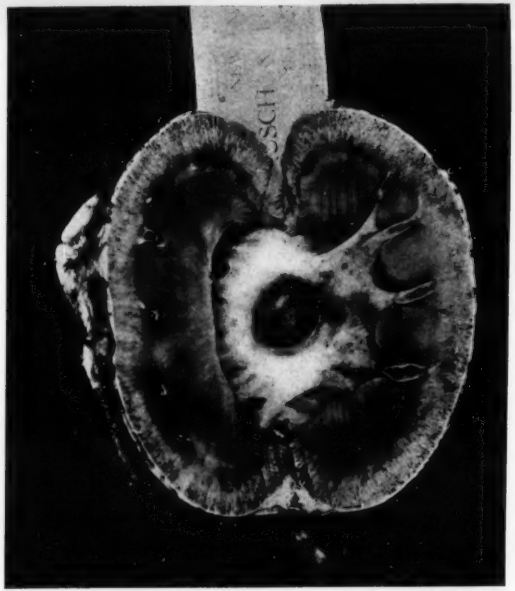
Dog 13, Mar. 1 to 10, 1910. In metabolism cage. Daily meat, 200 gm. Daily water, 500 cc. Daily urine averaged 260 cc.	*Color*, pale to normal. *Reaction* usually alkaline. *Specific gravity* averaged 1024. *Albumin*, very slight trace daily. *Sugar*, absent. *Urea* (Squibb's apparatus) averaged 3.5%. *Sediment*—hyaline and finely granular casts, triple phosphate crystals, amorphous phosphates, squamous cells, small round cells, mucous. Casts were absent on two days.
Mar. 11, 1910. Ureter ligated.	
Mar. 11 to 18, 1910. In metabolism cage. Daily meat, 200 gm. Daily water, 500 cc. Daily urine averaged 147 cc.	*Color*, normal. *Reaction*, acid (constant). *Specific gravity* averaged 1030. *Albumin*, very slight trace. *Sugar*, absent. *Urea* (Squibb's apparatus), averaged 3.17%. *Sediment* contained, in addition to the elements noted above, calcic oxalate crystals from the kidney pelvis, a little free fat. Casts appeared daily.
Dog 15, May 5 to 13, 1910. In metabolism cage. Daily meat, 200 gm. Daily water, 500 cc. Daily urine averaged 148 cc.	*Color*, normal to high. *Reaction*, acid (constant). *Specific gravity* averaged 1041. *Albumin*, slight trace. *Sugar*, absent. *Urea* (Squibb's apparatus), averaged 4.56%. *Sediment*, calcic oxalate crystals, free fat, mucous, spermatozoa, squamous cells, neck of bladder cells, squamous cells, triple phosphate crystals, granular detritus. No casts were seen.
May 13, 1910. Ureter ligated.	
May 16 to June 8, 1910. In metabolism cage. Daily meat, 200 gm. Daily water, 500 cc. Daily urine averaged 142 cc.	*Color*, normal. *Reaction*, alkaline (occasionally acid). *Specific gravity* averaged 1027. *Albumin*, very slight trace. *Sugar*, absent. *Urea* (Squibb's apparatus), averaged 2.84%. *Sediment*—triple phosphate crystals, mucous, squamous cells, round cells, free fat, amorphous phosphates, spermatozoa, granular detritus. On one occasion there were a few granular casts.

In the case of Dog 15, on whom several subsequent operations were done for other purposes to be described at another time, the daily urine was recorded for another period of 23 days, making a total record of 46 days from the time of the first operation. In this instance the urine averaged 142.5 cc.

the time of the first operation. In this instance the urine averaged 142.5 cc.



A



B

Fig. 4

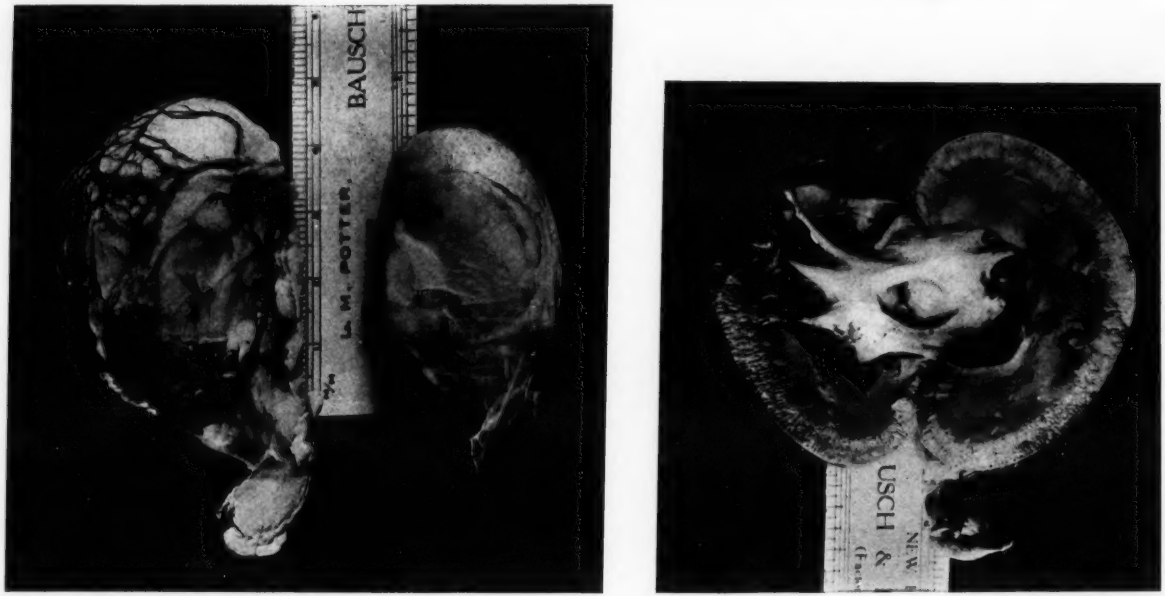
Dog 10. Seven days. Hydronephrosis.

A. Showing increase of size over normal; great dilatation of ureter, especially at its upper end, but without tortuosity; early and extensive development of capsular vessels.

B. Interior of renal sac showing great size of pelvic outlet, and relation of blood vessels to papillae and calices (these have been dissected out on one side.)

Owing to the extensive development of capsular vessels at this early date it is likely that extensive hydronephrosis would have eventually occurred.

PLATE XII. — Presented by DR. J. DELLINGER BARNEY



A B

Fig. 5

Dog. 2. Eleven days. Hydronephrosis, hydroureter. A. Extraordinary dilatation of capsular vessels, unsually great dilatation of ureter. B. Marked dilatation of pelvic outlet. Interlobular bands made prominent by thinning of cortex.

explanation is offered for this decrease in the output of urea beyond the fact that one healthy kidney cannot do the work of two in this particular regard; but that one kidney is ample to maintain a condition of perfect health is a matter of common knowledge.

It was stated that the urea was estimated by Squibb's apparatus, and the writer is well aware that this method is open to criticism. While the Kjeldahl test is undoubtedly the most accurate we have for the estimation of the nitrogenous output, we consider that for practical purposes the method employed is sufficiently accurate, especially as it has been used consistently throughout all our work.

It is important to state that dogs have not infrequently an apparently idiopathic nephritis, if we regard this to be indicated by the presence of albumin and casts, and coexistent with otherwise perfect health. This fact has been emphasized by other workers, more particularly Pearce, and is important for the reason that were its existence unknown we might be led to false conclusions. One of our animals (Dog 13) had such a condition before operation. Our experience has also been that the urine of the dog commonly contains albumin even in the absence of casts. Thus we have certain pathological factors to deal with at the start, and our work and that of Lumière and Chevrotier shows that in normal dogs, even under constant régime, there is considerable variation from one day to another in the quality and quantity of the urine.

The question of temperature has been considered and one of the two dogs (15) was carefully observed in this respect. In the absence of infection in the kidney, or elsewhere, there seems to be no occasion for a rise of temperature, and as a matter of fact, none was noted. During the eight days previous to operation the temperature (rectal) varied between 102°-103° F. (normal for dogs); during the twenty-three days after operation the readings were the same, but occasionally fell to 101° F.

So much for the signs and symptoms of ligation of the ureter during the life of the animal. When it is considered, as stated elsewhere, that one dog lived 258 days and another 247 days, both in perfect health up to the time of death (the former was the subject of observation in the metabolism cage), it is readily appreciated that the operation has no effect upon the health of the animal.

Much careful study has been given by various investigators to the question of the production of nephrotoxins in the hydronephrotic kidney. Among the earliest workers in this problem was Nefedieff, who claimed that in such kidneys there was produced a specific poison, which, when injected into the same or other animals, would cause a distinct toxæmia or even death. He ascribed the high mortality of rabbits in the presence of a ligated ureter to the absorption of such toxins. More recently others have taken up this question and we find the work of Pearce, Amos, and Albarran and Bernard to be contrary to this view. While our own investigation has not touched upon this problem we regard Nefedieff's conclusions to be erroneous for two reasons. First, there is good evidence, soon to be set forth, that no reabsorption of the contents of the renal sac occurs; secondly, our animals lived in many cases for so long a period of time in perfect health that the presence and effect of such toxins can be eliminated on these grounds alone.

An autopsy was performed on every animal whether sacrificed or dying from other cause. As a matter of record the condition of the abdominal wound was noted in all of the seven rabbits, and in twenty of the twenty-six dogs. In the former every wound had healed by first intention. In the dogs fourteen of the laparotomy wounds had so healed, the others were more or less septic.

Upon opening the abdomen the following conditions were observed. Peritoneum clean, occasionally a small amount of free serous fluid. Omentum or intestine adherent to the peritoneal aspect of the incision, or to the site of the divided

ureter. In both rabbits and dogs the sound kidney and ureter appeared normal in color and size; but in two or three dogs it was evident that this kidney was somewhat larger than at the time of operation. The writer is, however, ready to acknowledge that this increase in size may have been more apparent than real, as no actual measurements of the organs were made. As the possibility of such an enlargement by compensatory hypertrophy has been suggested, and its actual occurrence declared to exist by others (Sollmann, Williams, Briggs and Cohnheim), especially in cases of long standing obstruction of the opposite ureter, the facts are recorded for what they are worth. As it is unknown, so far as we are aware, just how large the kidney of any individual animal should be with reference to the number of its glomeruli and the size of its secreting surface, and especially its proper ratio to the body weight, we regard this matter of actual compensatory hypertrophy to be still *sub judice.*

The kidneys whose ureter was divided and ligated presented, with one exception, a condition of hydronephrosis. The one exception occurred in Dog 5, sacrificed at the end of 126 days. In this case the same operation was done as in the other animals, and during the post-operative period two laparotomies were performed, one eight weeks and another twelve weeks after the primary operation, for the purpose of noting any changes in the kidney. The following laboratory notes describe the conditions found.

Dog 5. Figs. 1 and 2. Aug. 24, 1909. Young, black mongrel dog. Ether. Right ureter divided and ligated. Kidneys of equal size and of normal appearance.

Oct. 18, 1909. Dog in perfect health. Wound healed *per primam.* Laparotomy. Right kidney considerably smaller than left, firm, normal color. *Vessels of renal capsule not engorged.* Ureter thickened, not dilated; left kidney has not changed in any respect.

Nov. 20, 1909. Animal in good condition. Laparotomy. Right kidney now about two-thirds its former size, abnor-

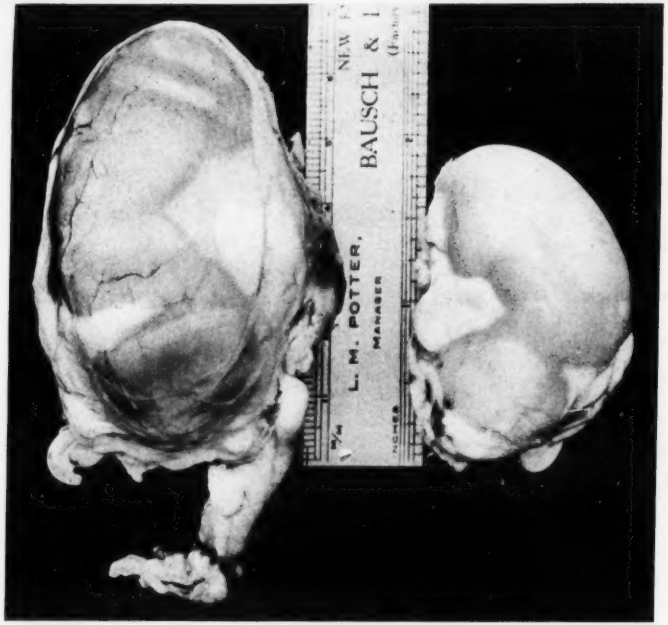
mally firm in consistency, dark in color, *capsular vessels not engorged.* Ureter distinctly fibrous.

Dec. 28, 1909. In good health. Has gained weight. Laparotomy. Right kidney has not changed since last note in size, color or consistency, but is about two-thirds the size of left. No dilatation of its pelvis or ureter. Left kidney normal. Animal killed.

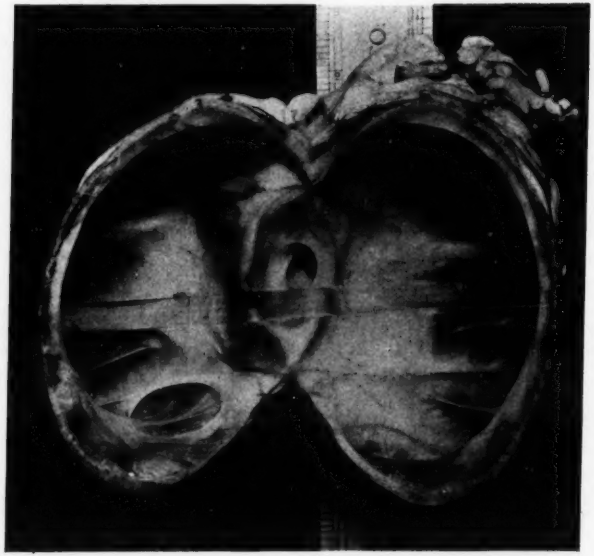
On section the right ureter is thick and fibrous, and contains a little grumous material. The kidney is fully one-third smaller than the left, pale, distinctly fibrous, its normal markings are obliterated and there is no dilatation whatever of its pelvis. The latter contains a few cc. of thick, cloudy fluid of urinous odor. (Lindemann also noted that the pelvis of the atrophied kidney was always empty.)

Here, then, is a case of true renal atrophy, which bears out the statements of the textbooks. It is significant that it is the only instance of its occurrence in our series of thirty-three animals. It is important to note that at no time was there any evidence of engorgement of the vessels of the renal capsule, or of anastomosis of these vessels with others. This has a most important bearing on the question, as will be shown later.

Hydronephrosis occurred in every other animal. The size of the organ varied, not only with the duration of ureteral obstruction, but also was greater in some animals than in others, even though the post-operative period was longer. The kidneys presented an increase in size all the way from one slightly greater than that of the normal organ, to one the size of a large grape fruit in a dog living 247 days (Figs. 3, 4, 5, 6, 7, 8). In many animals the kidney could not only be easily palpated during life, but also could be seen as a distinct tumor in the flank. This is well shown in Dog 6 (Fig. 9). Not only did the kidney itself show the same increase in size, but also the renal pelvis, which was frequently markedly dilated (see well in Figs. 7-A, 8). The ureters were uniformly tortuous, a fact also noted by Lindemann, es-



A



B

Fig. 6

Dog 3. Twenty-four days. Ligature of right ureter.

A. Hydronephrosis; hydroureter. Ureter tortuous. Capsular vessels moderately dilated. Kidney lobulated.

B. Interior of hydronephrotic kidney showing thinning of renal cortex, dilatation of ureteral outlet, and development of interlobular bands of connective tissue.

PLATE XIV. — Presented by DR. J. DELLINGER BARNEY

pecially at the pelvic end, where there was always to be noted an S-shaped curve (best shown in Figs. 10, 12), already described by Albarran and Legueu. In addition to their tortuosity the ureters were all dilated, some extensively so, and in practically all the dilatation was much more marked at the upper end than at the lower, a point which has been noted clinically and which is of interest. In no case have we seen diverticula of the ureter as described by Lindemann. In most of the rabbits and in a few dogs, the dilated translucent ureter was filled with a distinctly bloody fluid, an observation which we find to have been made by Cohnheim as well. The explanation of this will be given later in detail, but lies briefly in the intense hyperæmia which is one of the earliest effects of ureteral ligation.

It was also found that nearly every hydronephrotic kidney has descended to a point considerably lower than its mate (a fact which has not been mentioned by other authors), and this occurred quite as often on the left side as on the right. It is possible that the dilatation and tortuosity of the ureter is the determining factor in this downward displacement of the kidney. Owing to the generally horizontal position of the animal, it seems unlikely that the increase in the weight of the organ from its distention with fluid is a factor of any importance in the production of ptosis. Beyond this we offer no explanation for it.

Accompanying the condition of hydronephrosis, and, generally speaking, depending not only upon the degree of renal distention, but also upon its duration, there was noted, in all, a marked dilatation of the veins of the renal capsule (well shown in Figs. 4, 5, 11, 13, 14). In the case where true atrophy of the kidney was found *no such venous dilatation occurred* (Fig. 1). Careful dissection of these dilated veins reveals the fact that they form anastomoses with other vessels, some being developments of anastomoses already present, but ordinarily so small as to escape observation; others being of entirely new formation. In this venous net-

work the spermatic (or ovarian), the suprarenal, and one or two lumbar veins play the chief part. The writer takes this occasion to state his belief (which was also that of Lindemann) that in this development of venous anastomoses lies the secret of the production of hydronephrosis. If absent, as in Dog 5 (Fig. 1), atrophy of the kidney without hydronephrosis will occur. If present, hydronephrosis is inevitable.

So firm is our conviction that such anastomoses and hydronephrosis go hand in hand, one depending upon the other, that we are now engaged in ligating the veins mentioned (spermatic—ovarian—suprarenal and lumbar), simultaneously with the ureter in the belief that atrophy can thus be produced at will. The results of this investigation will be given in a later communication.

It was not until this condition of the capsular vessels and of the veins forming these anastomoses had been observed, that the writer found that a few others, especially Lindemann, who has done the most work on this question, had already noted these facts. This writer has stated that not only is there a venous, but also an arterial, anastomosis formed, the latter occurring in cases of long duration; but thus far we have been unable to corroborate this statement macroscopically. Lindemann's observations were based largely on microscopic evidence.

In order to demonstrate these anastomoses to best advantage, and in such a way that they can be brought to the attention of others, we have injected these vessels, the veins by way of the vena cava, the arteries through the aorta. The technique of this injection is simple, but satisfactory results are difficult to obtain, especially in the matter of dissecting out the vessels after injection. Many of those of the capsule are so small and so intimately associated with it, that to attempt to isolate them means destruction. The animals used for this purpose—Dogs 20 (Fig. 10), 22 (Fig. 11), 24 (Fig 12), 26 (Figs. 13, 14)—were allowed to live for periods of from

PLATE XV. — Presented by DR. J. DELLINGER BARNEY

Fig. 7

Dog. 4. Six weeks. Hydronephrosis, hydroureter.

A. Showing increase of size over the normal kidney; dilatation of pelvis and ureter, and tortuosity of the latter; development of capsular vessels. Lobulation not well shown. (See next Plate for B. and C.)

PLATE XVI. — Presented by DR. J. DELLINGER BARNEY

Fig. 7 (Continued)

B. Interior of A., showing marked thinning of renal cortex; great dilatation of ureteral outlet; interlobular bands.

C. Interior of ureter, showing development of valve-like folds along its course.

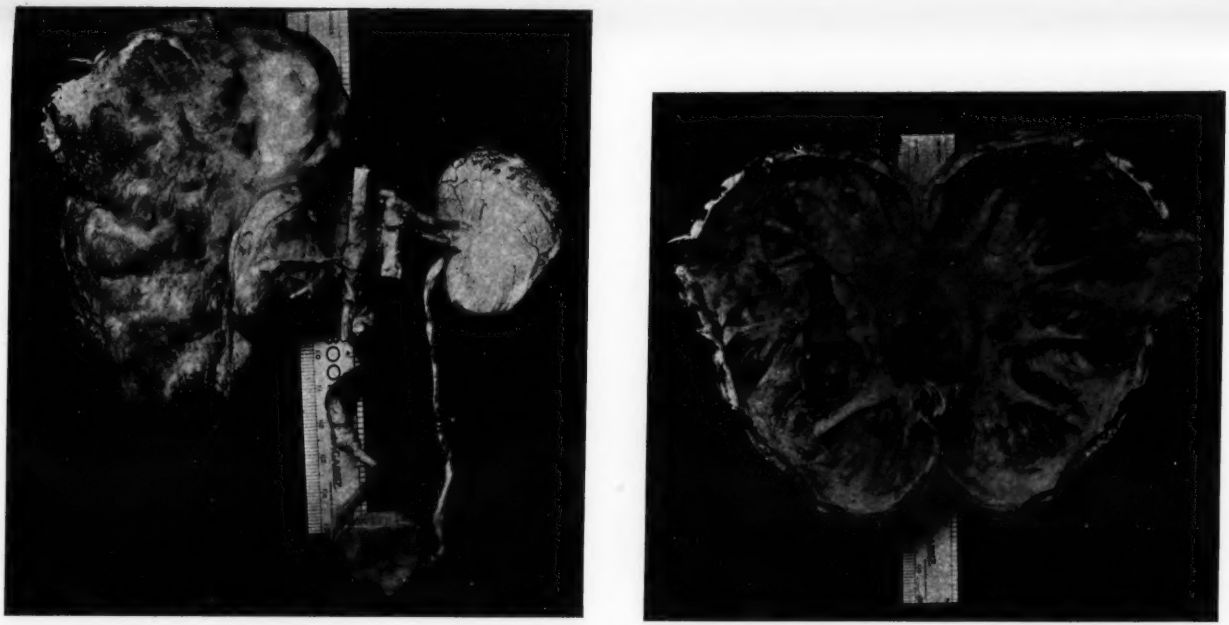
eleven days to eight weeks after ureteral ligation. At the end of this time they were killed under ether by dividing the abdominal aorta at its bifurcation. The vena cava was divided at the same point. After death the thorax was opened, and the superior vena cava and descending aorta divided. These vessels and their tributaries were then washed out with warm water until the return flow was practically clear. The inferior extremities of these vessels were then tied off with silk, and injection was made from above downward. The best injection mass was found to be a strong solution of gelatin (10-20%) colored with an insoluble pigment, ultramarine for the veins, vermilion for the arteries, and warmed to body temperature. Owing to the thickness of the vessel walls the injected pigments do not show their true colors either in the specimens or photographs, but as the vessels are rendered tense their outlines are readily distinguished. After allowing the gelatin to harden the specimens were removed *en masse,* including both kidneys, both ureters, the aorta, vena cava and all their branches (these were ligated before being divided to prevent the escape of the injection mass). The vessels were then dissected out as completely as possible, care being taken to preserve even the smallest branches and their relation to the larger trunks. The difficulties met with have already been mentioned.

Fairly satisfactory specimens have thus been obtained, illustrating the development of the capsular vessels and their anastomoses with the spermatic, ovarian and suprarenal veins on either side, and in both sexes. These are shown in the photographs (Figs. 10, 11, 12, 13, 14), but unfortunately only the specimens themselves can tell the whole story. The dilatation and development of the veins of the capsule is quite as marked on the outer border and posterior surfaces of the kidneys as in front. In the hope that at least a suggestion of these conditions might be given, a photograph was taken of the posterior aspect of the kidneys from Dog 26 (Fig 14). The size and number of the vessels are here well shown. It

will also be seen that in the normal kidneys no such network of dilated vessels appears, and there are no visible anastomoses formed with other veins. In some the capsular vessels can be seen as fine lines the size of a bristle; but in most they are altogether invisible. Another point noted to be seen in the specimens, but not well shown in the photographs, is that the vessels accompanying the ligated ureter are also markedly dilated, whereas those of the normal ureter are scarcely visible.

Let us now return to a consideration of the damaged kidneys and their contents. It has already been stated that they presented varying degrees of dilatation. Those of only a few days' standing showed no special change in their external markings beyond a moderate congestion and œdema. In those of long duration (a month or more) the organ appeared in all cases as a firm elastic cyst, the walls more or less thinned and having a lobulated or segmented appearance as shown in Figs. 6, 7, 8, 10. On opening such kidneys the cause of this lobulation is seen to be due to the extensive and irregular thinning of the renal cortex, the interior of the cyst being partitioned off by columns of dense fibrous tissue radiating fanwise from the ureteral outlet. That this division of the interior of the kidney is normal is shown in Fig. 15. This shows the interior of a normal kidney of an unoperated dog, the organ being divided longitudinally, and the calices and papillæ dissected out on one side. The same radiating columns are seen here as in the pathological specimen. On section these bands are found to contain blood vessels. These, with their fibrous sheaths, being comparatively unaffected by the intrarenal pressure, are brought into prominence by atrophy of the softer and less resistant renal tissue lying between them. The extremes of this condition are seen in the kidney of Dog 9 (Fig. 3) after five days, and in the kidney of Dog 6 (Fig. 8) after 247 days.

The renal substance presented all degree of thinning, being most marked in the older specimens, but not uniform in



A B

Fig. 8

Dog 6. Two hundred and forty-seven days. This shows a most extreme degree of hydronephrosis 13 cm. in length. Compare the size of the two kidneys. Note great dilatation of pelvis and ureter. Lobulation well shown. During life enormus vessels anastomosed freely over the hydronephrotic kidney, but are not seen in the photograph owing to deposit of fibrous exudate over kidney, the result of perinephritic abscess and pyonephrosis from which the dog died. In A, near top of outer border of kidney, and in B, in center of left side, is seen the point at which rupture of sac occurred by necrosis.

In B, note the extensive thinning of cortex development of interlobular bands, and dilatation of pelvic outlet.

Fig. 9

Dog 6. Ten weeks. Hydronephrosis. Shows bulging of right flank by enormous kidney. This dog lived in perfect health for 247 days after operation.

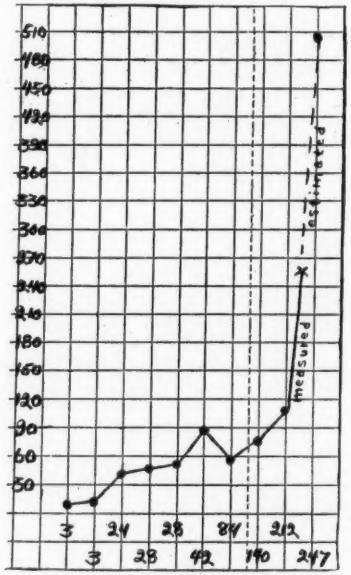


Chart showing amount of urine obtained from hydronephroses.

Figures on left indicate the amounts in cubic centimeters, beginning with one ounce.

Figures below represent the number of days after operation when urine was removed.

PLATE XVIII. — Presented by Dr. J. Dellinger Barney

any of them. In Dog 6, of 247 days' duration, the cortex is seen to be greatly thinned throughout; but this varies from about 1 cm. in some places to only a few mm. in others. On this point Cohnheim wisely remarks that a layer of renal tissue of only one mm. in thickness may, since it surrounds the enormous sac, be approximately equal in bulk to a mass ten to twenty times as thick arranged around the normal pelvis.

In all there was noted a marked dilatation of the pelvic outlet, this dilatation involving the ureter for more or less of its length, but always more marked at its upper end. Section of the ureter revealed not only an extensive dilatation and thinning of its walls, but also as shown in Fig. 7-c, an arrangement of valve-like folds of fibrous tissue giving it an appearance somewhat like that of the interior of the cystic duct.

As it is recognized by all, both experimentally and clinically, that an insult to the kidney often invites infection of that organ, and as some authors state that infection is sure to follow ureteral ligation, this point was investigated in three rabbits after intervals of three days in two, and fifteen days in one, and in two dogs at periods of six and twenty weeks after operation. In all the fluid contained in the kidney was sterile, a fact which would seem to disprove statements to the contrary, and which agrees with the observations of Gayet and Cavaillon. But in the case of Dog 6 and Dog 15, dying at the end of 247 days and 258 days respectively after operation, the renal sac had become badly infected, and was filled with pus. The writer is convinced that this infection was induced directly by further operations, with more or less rough handling of the kidneys, to which these animals were subjected shortly before death, and is equally sure from his experiences that what one might call a spontaneous infection of the kidney rarely occurs.

The contents of the hydronephroses were measured in ten dogs and examined fourteen times in eleven dogs. In one animal, the urine was examined on two consecutive days after

the establishment of a ureteral fistula. In another dog, on three different occasions, the ureter was opened, the renal sac emptied, and the ureter freshly ligated. This urine was examined and measured each time. As may be seen by the chart (facing page 216), the accumulation of fluid is gradual, is broken at one point by a decrease in the amount even after a period of time twice that of its predecessor, and rises abruptly only at the end of a period of thirty-five weeks. Even in this instance the amount is not accurate for while 250 cc. were actually removed from the kidney, an equal, if not greater amount, was lost before its source was realized.

The results of the examination of these urines are shown in the table which follows. (Page 219.)

It is seen first, that the reaction is acid as well in those of short duration as in those of long standing; secondly, that the specific gravity instead of decreasing as time goes on, maintains a fairly constant level, falling below 1010 only on one occasion. The presence of albumin in all is noteworthy, and not surprising under the circumstances. In those which showed the largest amounts it will be seen that the sediment contained considerable normal blood. These kidneys were emptied during the life of the animal, and in the course of this procedure the urine was contaminated by extraneous bleeding. Therefore the presence of large amounts of blood and albumin are not to be considered as representing the true facts. But, on the other hand, the sediments of those urines which were removed after death, and in such a way as to obviate the presence of blood (the fluid was aspirated with a syringe) show small amounts of normal and abnormal blood in most instances. This is to be explained as a result of the passive hyperæmia, which was noted in all the kidneys within a few hours or days after ligation, and which is later relieved to a greater or lesser extent by the establishment of venous collaterals.

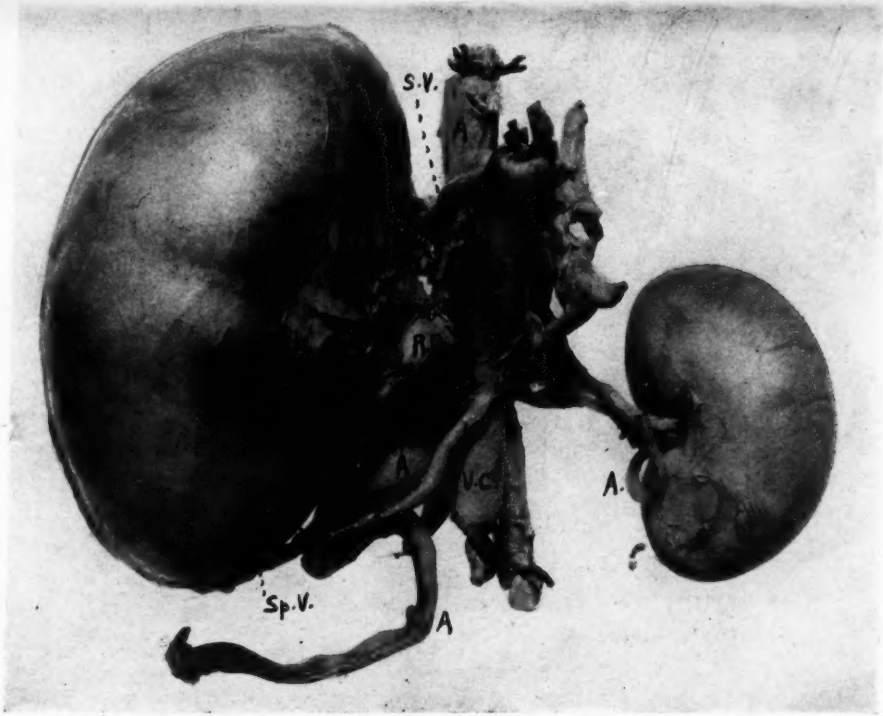


Fig. 10

Dog. 20. Four weeks. Male. Right hydronephrosis. Vessels injected. Marked tortuosity and dilatation of ureter, A, well shown. Lobulation of kidney pronounced. Spermatic vein, (Sp. V.) much dilated and supplying lower pole of organ. Its main branch to testicle not shown. Renal vein, (R.V.) much dilated, with many injected branches distributed over renal pelvis.

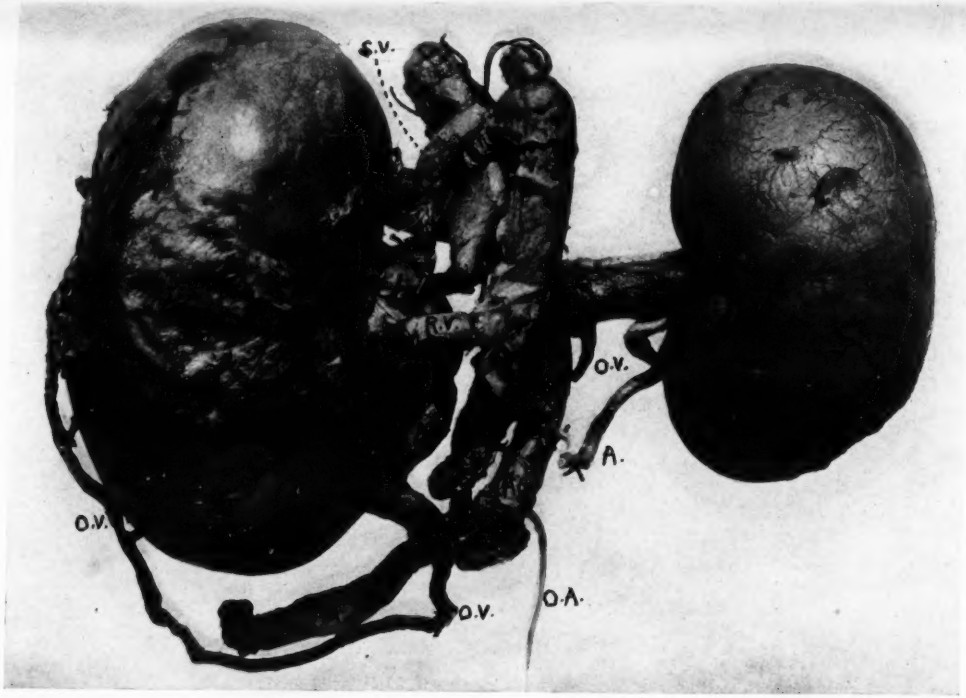


Fig. 11

Dog 22. Eight weeks. Female. Right hydronephrosis. Vessels injected (poorly). Ureter, A, very tortuous. Large branch of ovarian vein, O.V., running along lower pole and outer border of kidney. Branches of renal vein, R.V., distributed over pelvis. Suprarenal vein, S.V. dilated.

Aorta, Ao., Vena cava, V.C., ovarian artery, O.A. Ovary has been removed for the sake of clearness.

TABLE

Time after	Specific

TABLE

Time after operation	Color	Reaction	Specific gravity	Albumin	Sugar	Urea %	Sediment
3 days	Turbid yellow			slight trace	0	....	Hyaline and granular casts with leucocytes adherent; few leucocytes, round cells and calcic oxalate crystals.
3 days			....		.	0.37	Hyaline and granular casts with blood adherent, considerable blood, few large round cells.
5 days ureteral fistula	Pale	Alkaline	1010	very slight trace	0	1.01	Hyaline and granular casts, few clumps of pus, few squamous and round cells, little mucus and granular detritus.
6 days ureteral fistula	Turbid	Acid	1010	very slight trace	0	1.26	Sediment as before, but contains in addition a few triple phosphate crystals.
7 days	Cloudy	Acid	1020	very slight trace	0	1.01	Few hyaline casts, considerable normal blood, rare round cells, little mucus.
7 days			....		.	0.25	Few hyaline and granular casts, some with blood adherent, many blood cells, few squamous and round cells, little mucus.
24 days	Pale		1004	slight trace	0	trace	No casts. Few blood cells, many round cells, few leucocytes, much granular detritus.
28 days	Turbid		1017		.	0.5	
28 days	High		1020	1%	.	1.01	Normal and abnormal blood, few round cells. No casts.
42 days	Bloody		1016	1%	.	trace	No casts, normal and abnormal blood, many leucocytes and round cells.
84 days	Smoky	Acid	1012	¼%	.	0.5	Much normal, little abnormal blood, few large and small round cells, few leucocytes, few brown granular and brown stained epithelial casts.
140 days	Pale Bloody		1010	½%	.	0.5 0.63	Much normal, little abnormal blood, little leucocytes, rare hyaline and granular casts, few round cells with fat droplets.
212 days	Red		1012	trace	.	1.13	Many normal and abnormal blood cells, few round cells, numerous fine granular casts, some with epithelial cells adherent. No pus.
247 days	Red	Acid	1020	trace	.	0.76	Many blood cells, little pus, few round cells, a little mucus. No casts.

Urea was found to be low in all the urines, a point which agrees with the work of other authors. But that it does not necessarily decrease with time is shown by the fact that in one kidney four weeks after operation 1.01% was found; while in another case of thirty weeks' duration it appeared to the extent of 1.13%. That it is habitually low in the presence of an obstructed ureter is universally recognized, and is obvious from our own findings. That its production not only does not cease even after an occlusion of the ureter of long standing, but even may increase in amount under the same conditions, is shown in Dog 15, whose kidney was emptied on three occasions at intervals of twelve weeks, twenty weeks, and thirty weeks after the first operation. The urea in each of these urines increased each time, in the third specimen the amount being double that of its predecessors.

The sediments were found to contain casts in all but four. That time does not influence their appearance is shown by the fact that they were noted after seventy-two hours and again after thirty weeks, whereas they were absent in a case of six weeks' and in another of thiry-five weeks' duration. As it has already been shown (Dog 13) that casts may be present in the urine of a presumably healthy animal without operative interference of any sort, their presence after operation is not necessarily to be considered as a result of this interference with the intrarenal conditions.

Among other elements found in the sediments, pus cells are to be regarded as the most important. But that they are not always an evidence of the presence of bacteria is shown in Dog 4, living six weeks after operation, in whom the urine was sterile, whereas its sediment contained many leucocytes. The same is true of the urine of Dog 15 at the end of twenty weeks. It is not to be denied, however, that pus cells and bacteria generally go hand in hand, as shown in the urine of Dog 6, 247 days after operation and dying of a pyonephrosis.

PLATE XXI. — Presented by DR. J. DELLINGER BARNEY

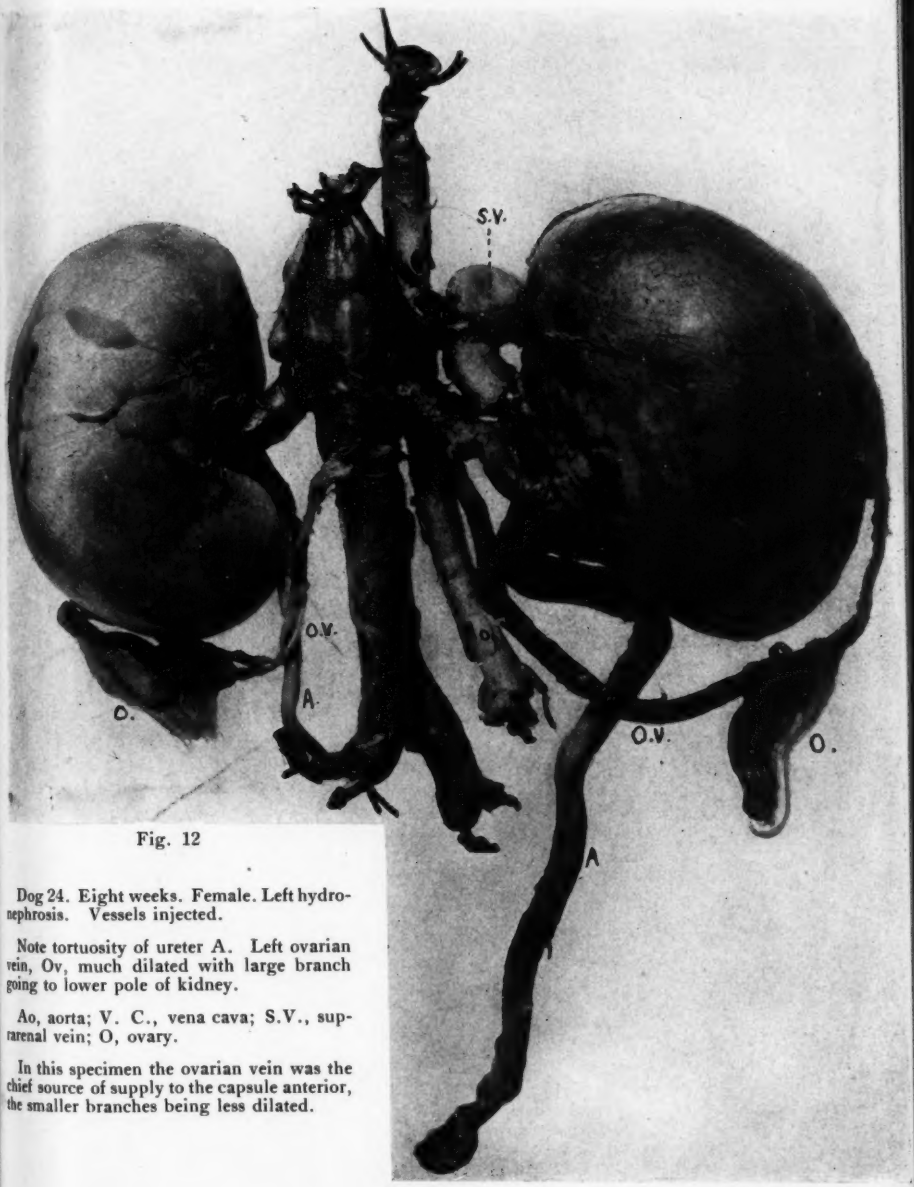


Fig. 12

Dog 24. Eight weeks. Female. Left hydronephrosis. Vessels injected.

Note tortuosity of ureter A. Left ovarian vein, Ov, much dilated with large branch going to lower pole of kidney.

Ao, aorta; V. C., vena cava; S.V., suprarenal vein; O, ovary.

In this specimen the ovarian vein was the chief source of supply to the capsule anterior, the smaller branches being less dilated.

A review of the literature shows that the results of examination of the urine in our dogs is essentially the same as that of other authors.

A point which has been investigated to a considerable extent, and which seems to have been largely settled by the recent work of Rosow, is the influence of ureteral obstruction on intrarenal pressure. The normal physiological pressure within the ureter and renal pelvis is known to be between fifty and seventy mm. Hg. But the experiments of Gottlieb and Magnus and of Obinski have shown that the ureteral pressure may not only be higher than this but also may exceed the blood pressure. It is also true as shown by Guyon and others, that at first the pressure in the ureter slowly rises, reaching its maximum in a few hours, and then slowly declines.

Rosow ligated one ureter in eight dogs (hydronephrosis occurred in each) and measured the ureteral pressure at periods varying from twenty-four hours to 263 days after operation. In each case the pressure of the healthy side was taken as a control. That of the pathological kidney decreased from about 90 mm. after twenty-four hours to only 6 mm. at the end of 263 days. On the healthy side the pressure remained fairly uniform, ranging between 100 mm. and 33 mm. Hg. Essentially similar results were obtained by Guyon in 1892, and again by Bainbridge in 1906.

Our own work along this line has been limited to one observation, made on Dog 15, thirty weeks after the original ligation of the ureter. On connecting this with a mercury manometer a pressure of thirty mm. was recorded, not only once, but several times. The accuracy of this observation is therefore not to be doubted, but the figure is somewhat higher than that obtained by Rosow at practically the same postoperative period. We have left this phase of the subject for future research for the reason that it is of enough interest and importance to warrant special study.

Before discussing further the question of ureter pressure and its relation to secretion in hydronephrosis, it is essential to review briefly the pathological changes found in these kidneys. This phase of the subject was to have been studied in detail in connection with our work by our late colleague, Dr. Walter R. Brinckerhoff. In the absence of his investigations, Dr. Wm. T. Councilman, Professor of Pathology at the Harvard Medical School, was good enough to summarize the pathology of our specimens as follows:

"... there has been in certain of the earlier cases a necrosis produced in the papillæ ... this necrosis is due to the anæmia which comes from the compression of the papilla on all sides, both without and internally, in consequence of the increased pressure within the pelvis of the kidney, and within the collecting tubules. The most conspicuous case of the necrosis is in Dog 7 after three days, so that I think the destruction of the pyramids is largely due to this condition. In other cases the necrosis was not so much in evidence, as, for instance, in Dog 8 (after three days), in which there is a very marked connective tissue induration of the pyramid, and which was probably secondary to a more diffuse injury. The general lesions of the cortex were those of injury and connective tissue increase. In the late cases, there had taken place enormous destruction of tubules, but leaving the glomeruli more or less intact."

The recent work of Sollmann, Williams and Briggs shows that:

"The capsule of the kidney, as well as Bowman's capsule, were slightly thickened. Most of the glomeruli were shrunken, and many were replaced by fibrous tissue. The epithelial cells of the convoluted tubules showed cloudy swelling, necrosis and pressure atrophy. Most of the tubules were obliterated. The collecting tubules ran generally parallel to the cortex and showed slight dilatation in places. The interstitial tissue was increased, with slight round cell infiltration.

PLATE XXII. — Presented by DR. J. DELLINGER BARNEY

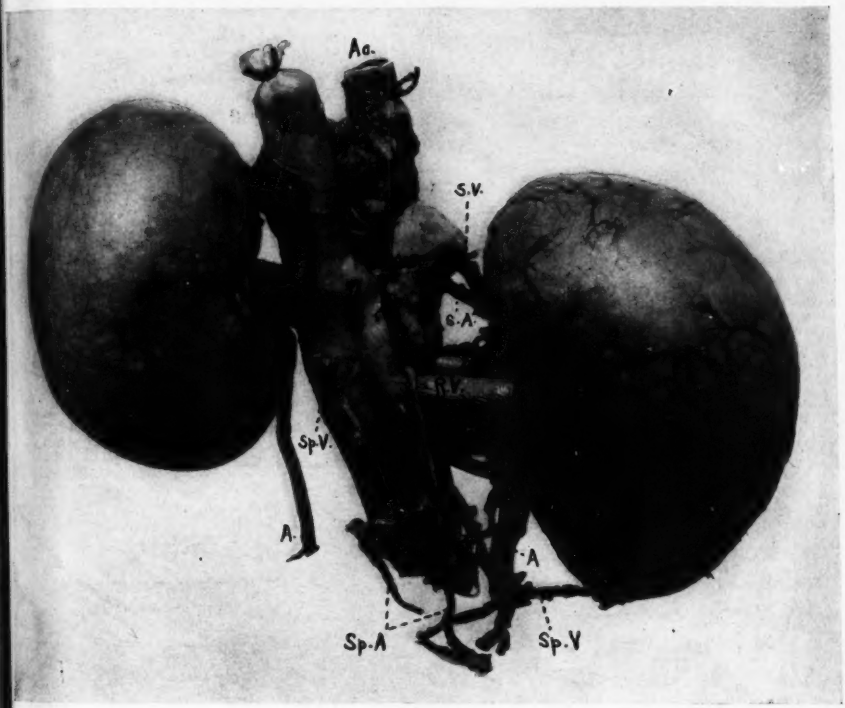


Fig. 13

Dog 26. Eleven days. Male. Left hydronephrosis, anterior view. Injection of vessels. Nephroptosis on left. Tortuosity of left ureter, A. Note branch of spermatic vein, Sp. V., going to lower pole of kidney, and suprarenal vein, S. V., supplying upper pole.

V. C., vena cava; Ao., aorta; R. V., renal vein; Sp. A., spermatic artery; S. A., suprarenal artery.

No engorgement of vessels of right kidney.

The arteries showed various degrees of endarteritis and periarteritis.

" Different areas in the same (operated) kidney are affected in very different degree, some areas appearing almost normal. The glomeruli are generally less altered than the tubules."

" *Sound kidneys*—The kidneys on the non-ligated side were always slightly enlarged, and microscopically showed slight cloudy swelling and moderate congestion, especially of the medulla."

Most authors are in accord with these findings, and they are well summarized by Lindemann.

" . . . the changes never occur suddenly in the whole kidney. . . . certain parts of the parenchyma, which lie near the periphery and are vascularized by anastomoses with vessels of the fat capsule, can preserve their structure much longer than the deeper lying parenchyma. These facts, as well as the fact that an increase of pressure in the ureter leads to a passive congestion of the kidney (shown by the oncometer) bear out the theory that in the genesis of the different disturbances occurring with hydronephrosis, those of the circulation play the important part.

" We can therefore distinguish three stages in the course of these disturbances, first, circulatory changes; second, the stage of tubule dilatation; third, the stage of atrophy. A marked line between them cannot be drawn."

Bearing all these factors in mind it is now essential to develop from them an explanation not only of their cause, but also of their effect.

We have seen that one of the earliest effects of ureteral ligation is an intense hyperæmia and œdema of the kidney, in other words, it exerts an influence on the entire organ (Cohnheim). The intrarenal pressure slowly rises by damming back urine which is being formed and producing a slow but constant tubule dilatation. This in turn compresses the venous capillaries and there occurs œdema and hyperæmia.

Following this there occurs a remarkable development of the rich anastomoses which normally exist between the renal, spermatic (ovarian), suprarenal and lumbar veins with those of the capsule, pelvis and ureter (Lindemann). Back pressure within the kidney gradually develops these venous anastomoses until they are able to compensate fully for those which have been obliterated by this very pressure, and urine secretion goes on uninterruptedly as evidenced by the increase in size of the kidney. It has further been shown by Lindemann and others, that what is true of the veins applies as well to the arteries, and he has shown that after a time the compensatory arterial supply is so good that the renal artery can be ligated without producing anuria. The vessels of the glomeruli form rich anastomoses with the arteries of the capsule, and pelvis, and these in turn anastomose freely with the spermatic (ovarian), suprarenal and lumbar arteries (Lindemann, Golubow—quoted by Lindemann).

However, in the later stages of ureter ligation, the pressure of dilated tubules and the overgrowth of connective tissue is so great that even the arteries are more or less obliterated and the development of a hydronephrotic cyst, at first fairly rapid, becomes more and more gradual, and may finally cease.

It is therefore obvious that not only upon the presence of these venous and arterial anastomoses, but also upon their degree of development, depend the results of ureter ligation. In the presence of a free blood supply (venous and arterial), hydronephrosis of considerable size is the rule; in its absence, atrophy is to be expected, as already observed by us.

And yet it is unreasonable to suppose that in the early stages of ureteral obstruction the ureter pressure in any given kidney will be different from that in another kidney. The subsequent developments rest wholly on the presence or absence of vascular changes.

Now we have ample proof (Bainbridge, Bainbridge and Beddard) that not only the glomeruli, but also the tubules

PLATE XXIII. — Presented by DR. J. DELLINGER BARNEY

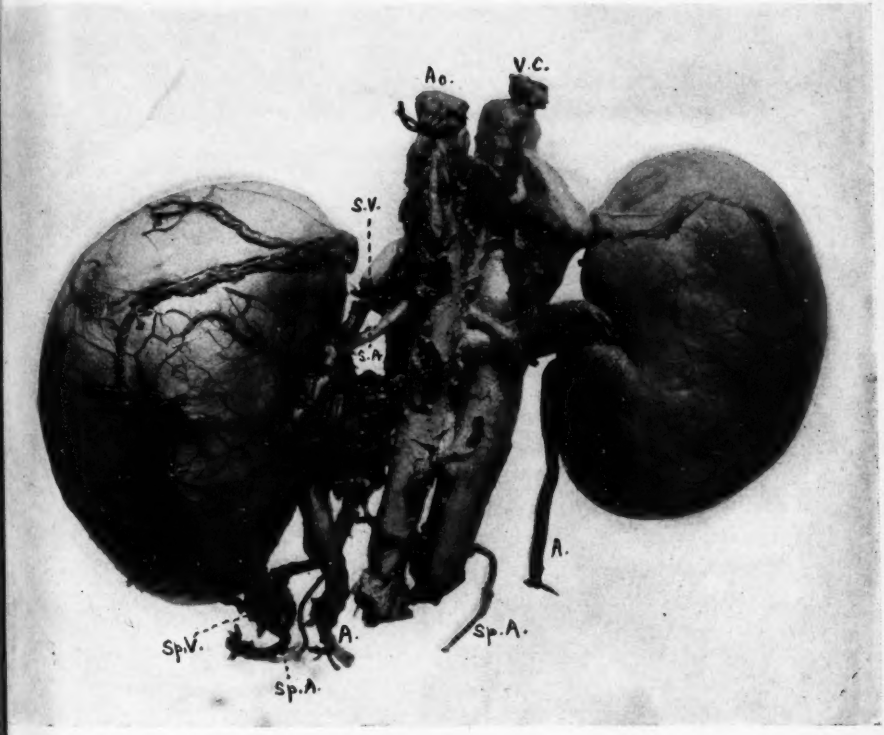


Fig. 14

Dog 26. Eleven days after ligature of ureter. Male. Lelt hydronephrosis. Vessels injected. Posterior view. Shows size, number, and distribution of vessels on posterior aspect of kidney. Compare with anterior view, Fig. 13.

take part in the secretion of urine. Further, all are agreed that the renal tubules are first destroyed, whereas the glomeruli can and do persist for a very long time. That their secretory activity is also preserved we consider to be proved by our own observations as well as those of others. On this basis we can explain not only the slow, but none the less continuous, increase in size of the renal sac, but also its ability to refill after the evacuation of its contents as shown in one of our animals (Dog 15) where the hydronephrotic kidney was emptied at intervals of twelve, twenty and thirty weeks after the primary operation.

We have already stated, and our experiments seem to prove, that no absorption of the contents of the cystic kidney occurs. Although Ludwig, and with him Cohnheim, believed that the renal tubules can reabsorb their contents, the work of more recent investigators (Lindemann, Bainbridge), shows this belief to be erroneous. Henderson has shown that water and a few slightly diffusible substances are taken up by the tubules. Generally speaking, no absorption takes place from the hydronephrotic sac.

Any discussion of ureter pressure and its relation to blood pressure must go hand in hand with the mechanism of urinary secretion.

According to Ludwig, the maximum pressure in the ureter represents the pressure when further urine filtration ceases in the glomeruli, i. e., the pressure prevailing in the glomeruli represents the maximum ureter pressure.

Heidenhain would have us believe that further urine secretion is possible even with maximum ureter pressure, but only on condition that the fluid separated by the glomeruli is reabsorbed again into the tubules.

But do these theories explain all the phenomena? Gottlieb and Magnus found that with artificial increase of the urinary secretion by different means of diuresis, a fall in pressure is noted even after the maximum rise of ureter pressure. Ludwig's theory explains this by a simultaneous

fall of blood pressure. But if we believe in Heidenhain's theory, the drop in ureter pressure is accounted for by the increased absorption in the urinary tubules. Gottlieb and Magnus have shown conclusively that no real connection exists between the great differences in blood and ureter pressure, while Lindemann, as well as Gogitidse and Waschetko (quoted by Rosow) and Bainbridge have demonstrated with equal clearness that no such absorption by the urinary tubules occurs.

Starling (quoted by Rosow) has advanced the theory that ureter pressure represents only a part of the pressure prevailing in the glomeruli, and that it is about 40 mm. lower than the blood pressure; that the pressure of the plasma albumin equals 40 mm. Hg., and infers from this that the ureter pressure may equal the blood pressure minus the osmotic pressure of the albumin. This idea would establish a direct connection between blood pressure and secretion. But unless the work of Obinski and Gottlieb and Magnus is very much in error, they have proved, first, that urine secretion can continue with a very low blood pressure; secondly, that ureter pressure can be greater than the blood pressure.

With these facts in mind, and from the work of recent investigators, we must doubt the correctness of Ludwig's theory; we must doubt the importance of blood pressure in the process of urine secretion, and we must believe that the chief part in the process lies in the activity of the tubular epithelium and in osmotic pressure.

This complicated question, to which a complete and satisfactory answer is still lacking, is perhaps best explained by Lindemann. According to him, the ureter pressure is equal to the difference between the osmotic pressure in the renal labyrinth and the capillary obstruction of the tubules. The degree of the osmotic pressure depends, first, on the richness of the blood in urine forming substances, and, secondly, on the blood supply which is in turn dependent on the blood pressure. As long standing ligation of the ureter is well

PLATE XXIV. — Presented by DR. J. DELLINGER BARNEY

Fig. 15

Interior of normal kidney of an unoperated dog. Calices and pyramids shown on the right, with blood vessels between. Note size of ureteral outlet.

known to produce far-reaching changes in the secretory epithelium of the kidney, and as this cellular degeneration in turn lowers osmotic pressure, by insufficient concentration of urine, and also decreases the amount of secretion, we find a partial explanation of the decrease of ureteral pressure varying fairly directly with the duration of the obstruction.

We can briefly summarize the effects of ligation of the ureter as follows:

1. In the absence of complications the operation does not affect the health of the animals. They gain weight and live for a very long time.

2. The urine from the sound kidney is not markedly changed after operation, either in quantity or quality.

3. The operation produces no rise of temperature.

4. There is no evidence of the production of toxins by the pathological kidney.

5. In the presence of a ligated ureter hydronephrosis, often of very large size, is produced in a very large majority of cases.

6. Its production depends entirely upon the development of anastomoses of the capsular vessels with others, and on the extent of these anastomoses depends the size of the hydronephrosis.

7. When these vascular changes are absent atrophy of the kidney is to be expected.

8. Infection of the renal sac is rare.

9. The urine of hydronephrosis is characterized by a low specific gravity, by a small percentage of urea, and by the presence of albumin, blood, casts and leucocytes.

10. After the evacuation of its contents, the renal sac can refill fairly rapidly, and can do this again and again.

11. Pathological examination of hydronephroses shows early and extensive tubule destruction, while the glomeruli may remain intact for a long period of time.

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OBSTRUCTIVE CALCAREOUS PAPILLITIS—RETENTION CYST OF THE KIDNEY

By John R. Caulk, M. D., of St. Louis

KIDNEY cysts have always created considerable controversy, particularly with reference to their genesis, which in most cases has been based on speculation rather than on an absolute etiological foundation.

The case which the author desires to report proved to have a definite pathological cause for the production of the cyst, and is submitted as a representative of the retention theory

of a cyst-formation in the kidney, the retention being due to a sclerosis of one of the papillæ whose tip was encrusted with a calcium phosphate deposit.

The history goes as follows: Patient, male, 46 years of age, single, farmer by occupation, was seen first in September, 1910, referred by Dr. Harvey G. Mudd. Complained of a dull aching pain in right side, beneath ribs, of occasional reflections along the course of the ureter into the scrotum, suprapubic soreness, low backache, pain in the right hip, slight increased frequency of urination, and hæmaturia.

Family history. Father died of cancer. No history of tuberculosis elicited.

Personal History. Has always been healthy. Typhoid fever at 21, uncomplicated. No pneumonia or other acute illness; no venereal taint; has never been a sufferer from any chronic pulmonary, cardiac or gastro-intestinal disorders, with the exception that he has been more or less constipated for several years. Has never used alcohol or tobacco to excess.

Present Illness. For several years has suffered with occasional aches in the small of the back and in the right hip, which were of slight consequence. A year and a half ago was suddenly seized with an acute colicky pain in the right side beneath the costal margin and right upper back. Pain was occasionally reflected along the right side into the scrotum, lasted twenty-two hours, but was less severe after the first few hours. During the latter period he experienced more of a sickening ache than of an acute pain. He was quite nauseated but did not vomit. Morphia was not required, but hot compresses were administered with some relief. After the subsidence of the pain there remained no soreness in the side. The attack was accompanied by a slight increased frequency of urination, slight hesitancy, some slowness and diminished force of the stream. There was, however, no pain or burning on urination. At the end of the siege, he voided a quantity of bloody urine after which he was relieved, and the pain

abated. Hæmaturia lasted several days, gradually fading away. The blood was always entirely mixed with the urine, never in the beginning or terminal. There were some clots. He did not pass "gravel." No chills, fever or sweats, but had creepy sensations. The aches in the back and hip ran parallel with the ache in the side, being aggravated during the colic and ceasing at the end of the attack. There was no jaundice with the attack. Patient has had five somewhat similar, though less severe, attacks during the last year and a half. The pain in the last attacks was never sharp, but of an aching, throbbing character. The hæmaturia was abundant in each attack, and lasted several days each time, gradually fading out. The last attack was two weeks before admission. For the past few months has had occasional soreness in the right side, between attacks. This soreness is always exaggerated on exercise, so that recently he has been unable to attend to his usual duties. There has been some diminution of the sexual appetite, erections weaker that usual. There has been no pain on ejaculation or defecation. General health far below par. Patient's appetite poor; he has lost twenty pounds in weight.

Status Præsens. Voids every two and one-half hours during the day. Does not get up at night. Stream slow to start, is small, and is voided with diminished force. No pain or burning on urination. Slight soreness in the upper right side, and the usual ache in the small of the back and right hip. Urine bloody.

Examination. Patient large-framed, good color, tongue lightly coated. Pupils normal; no general glandular enlargement. There are multiple subcutaneous fibroid nodules scattered over the surface of the body. No tophi. Heart and lungs negative. Reflexes normal. Abdomen normal in appearance, respiratory movements normal, no tenderness on palpation, kidneys not palpable, no tenderness in kidney regions, external genitalia normal. Urine glass, 1, 2 and 3, bloody; slightly acid in reaction, sp. gr. 1014, heavy trace of

PLATE XXV. — Presented by Dr. John R. Caulk

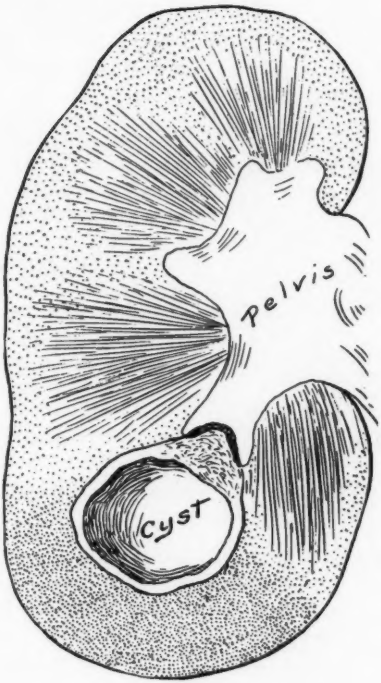

Fig. 1

albumin. No sugar. Microscopically, many red and white blood cells, epithelial cells, occasional hyaline cast, no granular casts, many colon bacilli. Urea fifteen grams to the litre.

Rectal Examination. Prostate moderately enlarged, distinctly indurated, particularly the right side. Slightly tender. Median furrow and notch shallow. Both seminal vesicles indurated. There is no intervesicular plateau. There are marked adhesions on the right side between the upper pole of the prostate and seminal vesicle and the lateral pelvic wall. The membranous urethra and rectum are negative. No enlarged glands in sacral fossa. "Prostatic secretion" contains a great many red blood cells, pus cells, and a few inactive spermatozoa. Stained specimen showed colon bacilli. Patient was put on hot rectal douches, rest, urotropin, and water in abundance. Two days later a cystoscopic examination was done with the following findings: Catheter passed easily. Recovered 250 cc. of bloody residual urine. Bladder capacity 600 cc. Cystoscope entered easily, showed a definite rounding in the median portion of the prostate, amounting almost to a lobe, from the margin of which blood could be seen oozing quite freely; internal orifice otherwise normal. Both ureteral orifices normal in appearance and seem to be ejecting clear urine at normal intervals. Bladder wall normal, no stone ulceration or trabeculation. With finger in rectum and cystoscope in the urethra, a slight thickening was found in the region of the median portion of the prostate.

Bleeding diminished slightly, and several days after the cystoscopic examination, the patient was endoscoped. There was found a large, dark-red, bleeding verumontanum and the whole posterior urethra extremely congested. Orifice of the utricle suggested nothing abnormal. In the light of the finding so far, it was thought that the symptoms were probably all of prostatic and vesicular origin, and that the pain in the right kidney region was a referred pain of prostatitis simulating renal colic. However, the patient several days before I saw him had been radiographed, and a shadow was found

in the bony pelvis low down on the right side with the probable diagnosis of ureteral calculus. Kidneys were pronounced negative. In view of this, it was thought best to catheterize the ureters. This was done, and both catheters passed directly to the renal pelvis without obstruction and withdrew perfectly clear urine. The bladder urine at this time was still bloody. The urinary examination on both sides was similar. Neither contained white blood cells, red blood cells, or bacteria. There were a few hyaline casts present on both sides; no albumin. Urea fifteen grams to the litre on both sides. A functional test with phenolsulphonephthalein was given. Six milligrams of the drug were injected hypodermically.

	Left Side.	Right Side.
Time of appearance.	Eight minutes.	Nine minutes.
	First hour, 18%.	First hour, 15%.
	Second hour, 13%.	Second hour, 12%.

These findings seemed to substantiate the idea that the symptoms were entirely referable to the prostate, seminal vesicles and deep urethra. However as we did not feel satisfied about the renal condition, ureter catheterization was again done with the same result as before, with the exception that a few red blood cells were found on centrifugalization. Patient was put on routine prostatic treatment with massage, irrigations, dilatations with the Kollman dilator, and applications of silver nitrate to the verumontanum. In three weeks he had greatly improved, the urine had cleared entirely and was free from blood. The prostate had decreased in size and the secretion contained fewer pus cells and only an occasional red blood cell. Four weeks after the institution of the treatment, the backache and suprapubic ache, and pain in the right hip had entirely subsided; urination free, every four hours; gain in weight, five pounds. Cystoscopic examination at this time showed that the median rounding had greatly diminished in size and that there was only 20 cc. residual urine. His only complaint at this time was soreness and an occasional throbbing in the right side, beneath the costal mar-

PLATE XXVI. — Presented by Dr. John R. Caulk

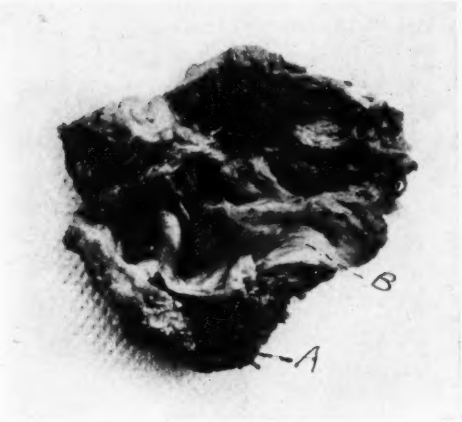

Fig. 2. Anterior view.

B. Cyst lining. A. Papilla with incrustation.

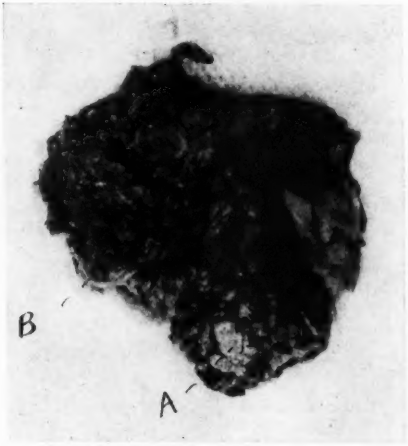

Fig. 3. Posterior view of Fig. 2.

B. Cyst wall. A. Papilla with incrustation.

gin. He was sent to Dr. Carman for a radiograph, and after a thorough fixation of the kidney with the Luffa sponge, the picture showed a very faint shadow in the region of the renal pelvis on the right side. On the strength of this picture and the finding of a few blood cells in the centrifugalized specimen of the previous ureter catheterization, a right lumbar nephrotomy was done.

Operation. Gas-ether anæsthesia. Oblique lumbar incision through muscles and fascia. The kidney, slightly adherent at the lower pole, was delivered and found slightly enlarged, particularly at the lower pole, which showed a slight rounding as in Fig. 1. The kidney was opened by the silver wire method suggested by Brœdel. The lower pole of the kidney did not open in the usual manner, owing to fibrous tissue changes. The upper pole opened easily and normally. The bleeding was slight and came mostly from the lower portion. On opening the kidney, a rounded mass, the size of a walnut, was seen in the region of one of the lower pyramids. By placing the hands on either side of the pelvis and invaginating it, it was found that the mass was a cyst which corresponded to one of the pyramids, and that the tip of the papilla was encrusted with the calcareous material shown in Figs. 1, 2, 3. The cortex in this region was denser than the remaining part of the kidney cortex and corresponded to the area drained by the papilla. There were no visible cysts in the cortex but the kidney in this region was very sclerotic. The cyst was easily shelled from its bed, which was quite unexpected, and its attachment to the pelvis was cauterized with the Paquelin cautery. There were no signs of malignancy. The kidney was closed wih interrupted mattress sutures of chromic catgut. Cigarette drain down to the kidney, wound closed in layers, except for the drain space. Skin closed with interrupted fine black silk. Silver foil dressing. Patient stood the operation well.

Post-operative course uneventful. Left the hospital on the twenty-second day. Wound entirely healed. The patient was

free from pain in his side and gradually gaining strength. He was seen several weeks ago; says he feels perfectly well; is not suffering any pain whatever. Attends to hard farm work, urinates normally, has never passed blood since the operation, and has gained twenty pounds in weight.

Pathology. The specimen consists of a mass about the size of a small walnut, pyramidal in shape, tensely fluctuant, having quite firm walls. At the tip there is a brownish calcareous material which covers it, as shown in Figs. 2 and 3. The specimen corresponds to one of the kidney pyramids with an incrusted papilla. On opening the mass, about a teaspoonful or more of clear amber-colored fluid escaped, which unfortunately was not saved for chemical analysis. However, it was found to be slightly alkaline in reaction. Sections were preserved in 4% formalin and blocks were made; one of them comprising the cyst wall and the tip of the papilla which was incrusted with the calcareous material. This was decalcified in 5% nitric acid. Other blocks were made from the different parts of the cyst wall. All blocks were mounted in paraffin, stained with hematoxylin and eosin. A chemical analysis of the incrustation, made by Dr. Shaffer, Professor of Biological Chemistry, showed it to be composed almost entirely of calcium phosphate.

Microscopic Examination. Section of the decalcified specimen made through the cyst wall and papilla with the incrustation shows that the tip of the papilla is covered with homogeneous material which takes the deep blue stain of decalcified material (Fig. 4). This material projects into the substance of the papilla as can be seen in Fig. 4. The tissue of the papilla is dense and fibrous and contains very few cells. The tissue in immediate contact with this homogeneous material has undergone hyaline degeneration. In this hyaline area, as the calcified mass is approached, numerous minute calcified granules are seen. Deeper in the substance of the papilla, the tissue is looser in texture and contains numerous small blood-vessels. There are also occasional collections of lymphoid

PLATE XXVII. — Presented by Dr. John R. Caulk

Fig. 4.

Microphotograph of papilla showing calcareous material.
A — Calcareous material covering and projecting into papilla.
B — Papilla showing dense sclerosis.

cells. The cyst wall is composed of dense connective tissue which in places is homogeneous. It has neither epithelial nor endothelial lining. It contains many dilated bloodvessels. Beneath the fibrous wall, the spaces vary much in size and shape. The tissue contains numerous tubular structures lined by cubical epithelium corresponding to the renal tubules. Some of the spaces are lined with flat cells with deep staining nuclei, others with various gradations between flat and high cubical. There are several large cystic spaces in the wall, lined in places by flat epithelium and in other places destitute of any epithelial or endothelial lining. Their lumina contain desquamated epithelium and red blood cells. The vascular tissue between the tubules contains lymphoid cells. The interstitial tissue is increased in places and there is considerable blood extravasation. There are no signs of any proliferation of epithelium or anything suggesting cystadenomatous changes. There are no glomeruli present in any of the sections, the cyst being entirely confined to the pyramid. (Figs. 5 and 6.)

There are several interesting points in this case to which attention is directed. In the first place, the diagnosis of the kidney lesion was quite difficult. From his history and from the first X-ray findings the patient was thought to have a ureteral calculus. The passage of a No. 7 ureteral catheter to the renal pelvis on each side, and the withdrawal of clear uncontaminated urine with no disturbance of renal function, seemed to eliminate the ureter as well as the kidney as seat of the trouble. Then with the definite high-grade involvement of the prostate, seminal vesicles and deep urethra, and the marked amelioration of symptoms after treatment was directed to them, these organs were thought to be the only offenders. Later examinations with the ureter catheter and X-ray proved this not to be the case, as did the continuation of the renal pain after the other symptoms had subsided. We were dealing with a double picture. The urinary distress, hæmaturia, and the lower referred pains were undoubtedly due to the prostate and deep urethra, and the upper pain to

the kidney. The case demonstrates how careful one must be in attributing a pain in the renal region to lesions of the prostate, vesicles and urethra. While the author has firm belief that such pains may originate from the genitals, still he feels that every possible means should be utilized to rule out the upper urinary tract before one reaches a final decision.

Whether the advent of acute colic in the disease was due to plugging of one of the straight tubules of the papilla by a small concretion or to breaking off of some previously deposited calcareous material, the author is not prepared to say, but is inclined to favor the latter hypothesis.

There are certain pathological features which seem worthy of special mention. The limitation of the cyst to the pyramid with its demarcation from the cortex is out of the ordinary. Why this happened is uncertain. There is no anatomical reason for it. It may be that the cyst was in its infancy and limited to the pyramid, and that in time it would have developed into a cyst of large size, occupying a great part of the kidney. I believe, however, that its full size was attained as the wall was quite thick and well developed. The most probable explanation of its limitation seems to be that it was a slowly developing cyst with an inflammatory reaction surrounding it which developed with greater rapidity than the cyst, thereby restricting its growth. The most striking observation in the case was the lesion of the papilla, which presented a dense sclerosis with incrustation of calcium phosphate, and which served as the cause of the cyst formation. The cause of the condition cannot be definitely determined as to whether the primary focus was a calcium infarct with a gradual deposition of salts and a secondary sclerosis or a primary necrosis with sclerosis and secondary calcification. It is most probable that it was the latter. It is extremely interesting that the process was confined to one papilla and that the others were, as far as could be determined, in a normal state of preservation.

Very little is written concerning inflammatory lesions of

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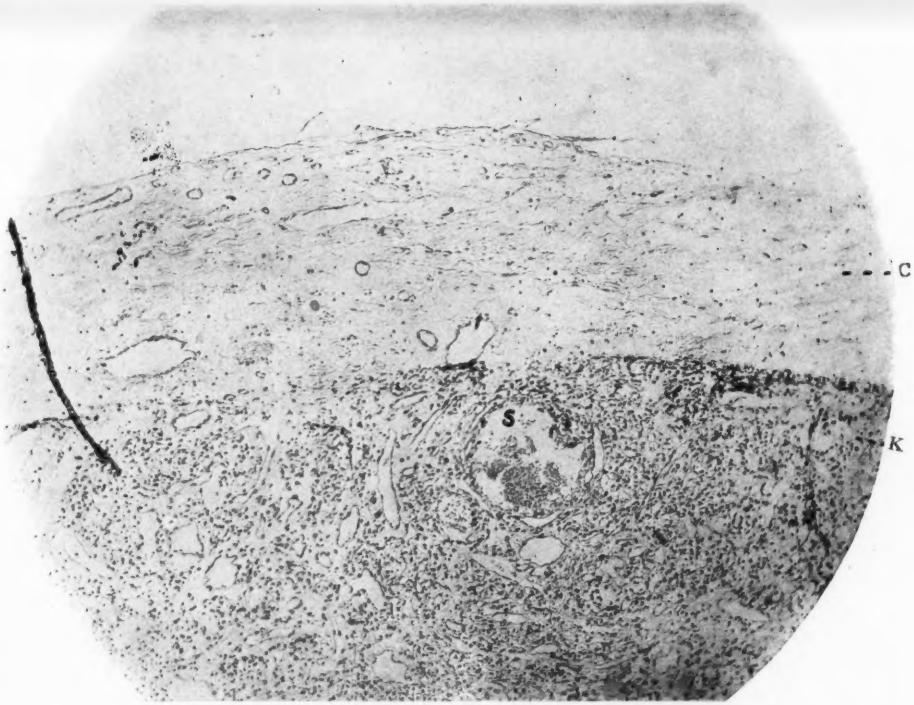

Fig. 5

C. Cyst wall. K. Adjacent kidney tissue.

S. Small cyst lined by cubical epithelium.

the renal papillæ. Tuberculous processes, the varicosities described by Pilcher and Cabot cannot be included in this category. Papillitis and papillary sclerosis are not mentioned in the ordinary text books; and in a very careful survey of the literature I was able to find but few references to it. Virchow and Rayer speak of pyelopapillitis fibrosa and consider the process the cause of kidney cysts. Kaufmann speaks of desquamative papillary catarrh which he found in association with uric acid and calcium infarcts and following the ingestion of certain poisons. Levaditi was able with vinylamin to produce a necrosis of the papilla followed by secondary sclerosis and incrustation of salts; and it has been found that certain drugs, such as glycerine, iodoform, aloin, and formalin occasionally cause necrosis and sclerotic changes in the papillæ. It is to be noted that these descriptions are findings of research investigations and not clinical observations. The author has not been able to find any mention of the lesion in the perusal of the surgical literature at his disposal. The lesion presented in the above case of a dense papillary sclerosis with incrustation of calcium phosphate confined to one papilla is, as far as he has been able to determine, unique.

Pathogenesis. In 1841 Willis differentiated between cysts apparently of new formation and cysts through dilatation. He does not, however, mention the cause of the dilatation. In 1844 Rujssenaers said that all cysts originated from the urinary canals, both through mechanical stoppage with retention of secretion and as a result of inflammatory processes by which the urinary canals grew together in places and the free parts continued secreting. Frerichs in 1847 remarked that cysts originated from dilatations of the Malpighian capsule, through obliteration of the urinary canals in consequence of inflammatory processes, with obstruction of the canals. In 1851 he explained the genesis of kidney cysts by obstruction of the canals caused by plugging of the lumen with fibrous exudate and a contraction of the newly formed stroma in the

region of the tubules. In the middle of the nineteenth century there appeared the publications of Rokitansky, Schraut, Paget and Gairdner, who thought that cysts were due to a rupture of the uriniferous tubules and a shedding off into the intercanalicular connective tissue of epithelial cells which developed in the form of cysts. Rokitansky thought that cysts were formed by a metamorphosis of the cells of the Malpighian bodies, which produced cysts through pressure. Schraut believed in a colloid metamorphosis of the connective tissue cells as a cause of cysts. Gildemester observed colloid droplets in the epithelium of the uriniferous tubules. Albarran says that a serous cyst is a simple variety of polycystic degeneration, the cysts having united and the walls having been absorbed to form a single cyst. Simon states that the canals are most frequently the origin and that Bowman's capsule takes part in the general distention. Johnson gives several explanations for the origin of cystic formations in the kidney: (1) A destruction of the epithelium of the canals through which the urine can not be sufficiently removed from the parts of the canals which are still capable of secreting; (2) stoppage of the canals in the neighborhood of the pyramid by substances which have been washed down from above in the region of the Malpighian body; (3) circulatory disturbances of the capillaries of the Malpighian bodies either alone or in association with the above-mentioned causes which produce a cessation of the passing off of water; thus the power is lost which keeps the urinary canals patent. Klein thinks that cysts originate in the Malpighian bodies. In 1856 Virchow gave four possible origins for cyst formation: (1) Cysts due to obstruction of the straight canals by lime salts, carbonate and phosphate; (2) apoplectic cysts; (3) cysts in scars; (4) colloid cysts. Virchow later abandoned the theory of retention due to concretions, and believed the cysts to be caused by retention secondary to a sclerosis around the tubules in the papillæ (pyelopapillitis fibrosa). The next defender of this theory was Rayer, who thought cysts were

caused by stoppage of the canals due to scar-like contracture of the connective tissue in the papillæ.

The retention theory has many partisans. The abnormal growth of connective tissue is the agent of the constriction; this is most common in the age of arteriosclerosis when cysts are most frequent. Severi, Guinsberg and Hartmann accept this opinion. Newman holds a somewhat analogous opinion, but believes that the obstruction may be caused by deposits and exudation. In 1856 Albers divided cysts into those due to diseases of the Malpighian bodies and those due to diseases of the Malpighian bodies and urinary canals. He thought that, as the result of a light inflammation, the urinary canals were closed below, while there was dilatation above with accumulations of inflammatory exudate. The same year, Beckmann divided kidney cysts into (1) true cysts; (2) cysts originating in the Malpighian bodies; (3) those from obstruction of the uriniferous tubules. Concerning the latter, he says that they are nothing more than small atrophied places along the course of the urinary canal with retention of contents due to the fact that the contents are too thick to pass because the *vis a tergo* of the glomerulus fails as a result of atrophy. He does not think that true cysts can come from these. Neither did he believe that colloid changes could produce cysts. Hertz recognizes four kinds of cysts: (1) New formations due to an exuberant growth of connective tissue with colloid changes of the central part; (2) cysts originating from changes in the epithelium of the gland substance itself; (3) cysts from blood extravasation; (4) true retention cysts. He does not admit the stoppage of the canals with salts as the cause of the retention. The reason, he says, that large cysts are not frequently found in nephritis is explained by the fact that the glomeruli and upper uriniferous tubules become functionless through other changes of the disease, and cease secreting. Sturm in 1875 said that cysts originate as an adenoma. First there is an epithelial proliferation, later fatty degeneration and cyst formation. Simon thinks this theory untenable as

epithelium is not constant, and when present is not in a state of activity. Rindfleisch in 1878 considered all cysts the accompanying process of inflammatory conditions. About this time, Cornil, Brault, Sabourin, Malassez, Lejars, and Goodhard were advocates of the inflammatory theory, but thought that retention alone could not sufficiently explain the cause of the cysts. They believed that there was evidently some activity of the epithelium. Thorn in 1882 remarked that the development of cysts through contraction and obstruction of the canals is definitely proved in chronic interstitial nephritis, and needs no further explanation. Leopold reported a case of a large blood cyst which he believed was due to retention within the canals. Weichselbaum and Greenish in 1883 thought, as Sturm, that cysts may result from adenomata. In the following year, the views increased in regard to the belief that the cause of cysts was obstruction due to connective tissue changes. The adherents at this period were Marchand, Durlach, Chotinsky, Birch-Hirschfeld, Stöhr and Philippson. Birch-Hirschfeld leaves the question of origin of solitary cysts open, but thinks that most probably they are due to retention from plugging of the canals. Philippson thinks that cysts may originate in the glomeruli and in the canals both from obstruction within and from without the canals. In the next year, Schmaus, Israel, von Brackel and Forbes expressed their belief in the chronic inflammatory theory of cyst formation. Therburg differentiated between cysts of Bright's disease, isolated cysts and cystic kidneys. With reference to the isolated cysts in otherwise normal kidneys, he did not commit himself. Strübing believes that large solitary cysts could not originate from stricture of the canals; he leaves their genesis an open question. Regarding small single cysts in an otherwise normal kidney, he holds it possible that a circumscribed interstitial contracture can evoke it. Ziegler differentiates single cysts in a normal or only slightly altered kidney from multiple cysts which occur as an accompanying process of chronic interstitial nephritis. Concerning the

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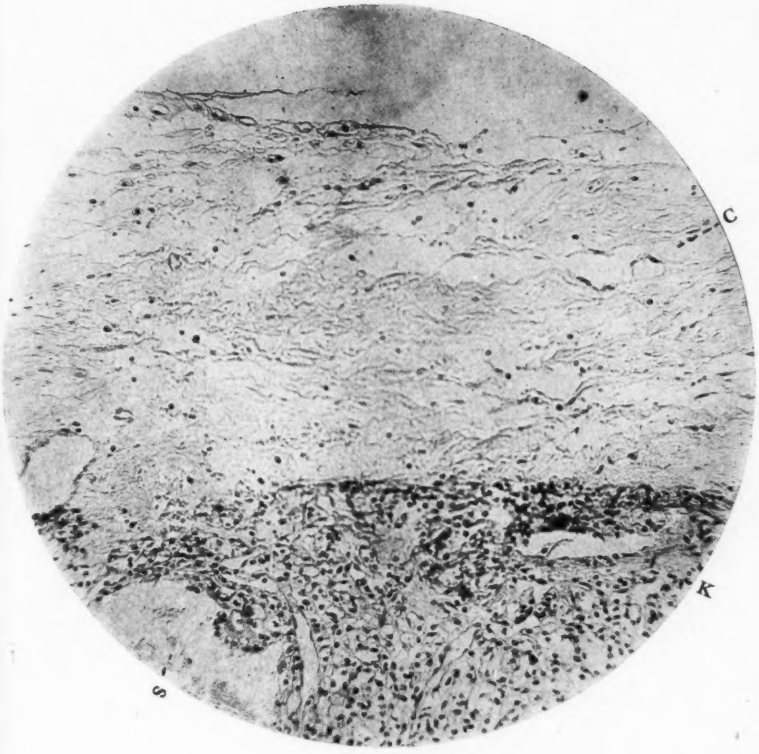

Fig. 6. Same as Fig. 5. enlarged.

C — Cyst wall.
K — Adjacent kidney
S — Small cyst lined by cubical epithelium

genesis of the former he says nothing. Arnold describes a case of congenital interstitial nephritis with cysts, and, in 1895, Lust reported a similar case. Claude in 1896 regarded cysts as a specific new formation somewhat analogous to the "*épithéliomas mucoïdes*" of the ovary and testicle. Singer considers the formation as due to contraction caused by new-formed connective tissue, but he thinks that for many cysts a satisfactory explanation is lacking. Some, he thinks, may originate in fœtal life. Ribbert believes that single cysts, in an otherwise normal kidney, may be due to an arrest of development. Ottendorf is an advocate of cyst formation due to stricture of the canals from connective tissue contraction. Aschoff says that cyst formation must be considered differently in different circumstances, and a uniform genesis is not determined. He seems to think that there must be some irritation producing an increased secretion.

A view entirely different from any which has been expressed was proposed by Krause in 1899. He describes a walnut sized cyst, and says that its origin started in an early period of life when there were still present separate kidney lobules. One of the lobules served as the origin of cyst formation. He describes obliteration of one of the branches of the renal artery with an atrophy of the corresponding lobule. Later there occurred an inflammation and fatty degeneration of the lobule which became entirely encapsulated and formed the cyst he described. Ruckert is unable to explain the origin of cysts in otherwise normal kidneys. In 1902 Hartmann explained the origin of certain cysts as related to adenoma. He observed slender papillæ in the walls of some of the cysts and called them *cystome papillaire*. He says that a transition can be observed from an adenoma to a *cystome papillaire*. The recent case of Squier of malignant adenoma of the kidney with the cyst at one pole is of a similar nature. Delbet in 1903 studied the origin of cysts and attributed many of them to trauma. Traumatic uronephroses, he says, are caused by obstruction of the canals by clots with resulting cicatricial stric-

ture. He thinks that what he terms traumatic uronephrosis may be the serous cysts of other authors. Ruckert in 1903 remarked that all cysts of the kidney are congenital, and owe their existence to faulty fœtal development. This idea is substantiated by Braumworth. They believe that the only difference between simple or single cysts of the kidney and cystic kidney is one of degree. In 1904 Dunger opposed the congenital idea and believed, as many of the older writers, in the retention theory of cyst formation. Kaufmann in the same year recognized three types of cysts: (1) Solitary cysts originating from arrested development in fœtal life with secondary stricture processes; (2) many cysts in contracted arterial sclerotic kidneys, partly retention and partly secretory; (3) congenital cystic kidney. Lubarsch is an adherent of the inflammatory retention theory, and thinks Ruckert's statement, that all cysts of the kidney are congenital, is unjustifiable. He examined the kidneys of new-born and infants and found cysts in 32%. In the kidneys showing inflammatory changes there was a larger percentage of cysts. In 500 kidneys of patients over fifty years of age, he found 79% of cysts, macroscopically. He says that one can only say a cyst is congenital when no other cause can be found. Thompson believes with Hildebrandt that certain kidney cysts are due to failure of union of the two canal systems in fœtal life with the consequent retention of secretion.

In the more recent literature, the same diversity of opinion exists concerning the genesis of kidney cysts. Lipskeroff in 1911 stated that solitary cysts of the kidney are rare and he collected twenty-two cases from the literature. This seems a small number, as Simon in 1906 collected fifty-two cases. Lipskeroff considers his case of adrenal origin. About the same time Brockenheimer reported his case of large cystic tumor in a horseshoe kidney, and expressed the view that it arose from some obstruction to the canals with retrodilatation and cyst formation. At the meeting of the French Association of Urology at Paris in 1911, a symposium held on kidney

cysts evoked the same unsettled state of affairs concerning the origin of renal cysts. Letulle and Verliac defended the theory of congenital malformation as the origin of most cysts, while Pousson supported the chronic inflammatory theory with retention.

A glance over the above compilation evidences a lack of uniformity of opinion concerning the genesis of kidney cysts. The theory that colloid changes of the epithelium and connective tissue cells serve as the origin of cysts, an idea which was held by some of the older writers, has become abandoned. The two important theories are the congenital and the retention, each having a long list of adherents. The view is prevalent that cysts even of moderate size can not originate through obstruction of inflammatory origin. This is undoubtedly erroneous, as can be proved by the author's case in which there was a definite obstruction with a fair sized cyst. Evidently some of the cysts in " so-called " otherwise normal kidneys, which have been thought to be congenital in origin, might have been due to obstruction of inflammatory nature, as, in many cases, a careful microscopic examination in the region of the cyst was not made, and it is possible that the lesion might have been overlooked.

Those who contend that all kidney cysts are of congenital origin are unquestionably making a statement which is unjustifiable. It seems evident, from the review of the cases which have been reported, that some of the cysts must be considered of congenital origin, while the majority seem to belong to the class of retention cysts following obstruction.

Etiology. The etiology is obscure in most cases as can be observed from the study of the literature. Serous cysts are quite infrequent. In 2610 autopsies at the Middlesex Hospital, Morris met with but 5 cases. Israel found but one in 297 surgical affections of the kidney. Simon in 1906 collected fifty-two cases. Brin in 1911 compiled 53 cases. The malady is one of adult life. Simon's report reveals but seven under twenty years of age. Wagner's case,

four years of age, is one of the youngest, and the case of Fox, seventy years of age, is one of the oldest. Males and females seem about equally liable to the disease. However, this point is subject to differences of opinion. Albarran reports a slight advantage to the male, whereas Tuffier gives a proportion of twenty to three in favor of the female. Fowler reports twenty-two females and twelve males. Newman's two cases were both males. The right kidney seems to have been more commonly affected. Fowler gives a proportion of twenty-two to ten in favor of the right. There seems to be no definite association with any particular disease, though many have reported such diseases as pneumonia, typhoid fever, dysentery, gall-stones and gout as precursers. Pousson says that any disease which is liable to produce nephritis may lend a hand to the production of kidney cysts. Certain drugs and poisons have been thought to be of etiological moment. Among them are corrosive sublimate, phosphorus, glycerin, aloin, vinylamin, etc. The cyst production is thought to be due either to a papillary necrosis with secondary incrustation with salts, as in the experiments with vinylamin, to an infarct with subsequent papillitis, retrodilatation and cyst formation. The experimental work which has been undertaken with a view of producing cysts has been of two classes: the first being an attempt to produce an obstruction to the outflow from the tubules by various mechanical methods directed to their exit, the papilla; the second consisting in the administration of certain chemicals which seem to possess a selective action upon this particular location. Of the first type of experiments, those of Petterson and Tollens are the most significant. Petterson, after bisecting the kidney, placed a silk thread in the papilla with the hope of setting up a progressive inflammatory reaction around the foreign body. In the experiments there developed granulation tissue which plugged a number of the canals, and a moderate dilatation of the canals ensued, but later an excess of connective tissue

developed which compressed these preliminary dilatations and the final result was atrophy.

Tollens cauterized single papillæ in order to get a definite localized obstruction. He studied the kidneys four, eight and a half, and twelve weeks after the experiments. At the end of four weeks there was complete obstruction of the ducts of the papillæ with retention of secretion and moderate dilatation of the canals of the cortex and the medulla, lined with cuboidal and flattened epithelium. After eight and a half weeks there was more connective tissue, and the dilatation was less marked. At the end of twelve weeks there was still dilatation, most marked in the straight canals, but no definite cysts.

It would seem that there are possibly two extremes exemplified in these experiments. In the first, it is probable that the foreign body did not cause a sufficient reaction to stimulate a progressive obstruction; hence the result. In the second, by cauterizing the papilla there was produced a sudden complete obstruction. Under such circumstances one would expect exactly what happened, that is, a temporary dilatation with subsequent atrophy, similar to what would result if the same process was applied to the ureter or to the excretory duct of any gland. Had the obstruction been intermittent, incomplete, or progressive, it is easy to conceive that a dilatation and cyst formation would have been produced; just as hydronephrosis arises under like circumstances.

A very interesting series of experiments, bearing upon this subject and representing the selective action of chemicals upon the papillæ, was conducted by Levaditi, who was able by a subcutaneous injection of vinylamin to produce a papillary necrosis and sclerosis similar to the lesion described in the author's case. In his experiments he used mice, rabbits, guinea-pigs, and goats, and was able to regulate the dosage in order to produce either an acute or chronic poisoning.

Vinylamin is a strong poison, and .03 gr. of vinylamin hydrochlorate per kilogram kills a rabbit in four to six hours,

while 0.012 gram per kilogram causes a subacute poisoning, the animals living from two to seven days or longer Smaller dosage insures a chronic poisoning, and the animals may live for weeks following repeated small injections. In cases of acute poisoning, marked nervous phenomena occur, such as nystagmus, increased secretions, finally, convulsions and coma. Death results from respiratory paralysis. The important changes at autopsy were the hæmorrhages and hyperæmias of uropoietic tissues. In cases of chronic poisoning, the most interesting manifestations which are of interest in conjunction with this paper, are the lesions found in the pyramids and papillæ, namely, hæmorrhagic infarcts and necrotic changes, the cortex being unaffected. There was generally a sharp line of demarcation between the cortex and the medulla. The remainder of the urinary tract demonstrated occasional hæmorrhages and ulcers. In the very chronic cases Levaditi observed a calcification following the papillary necrosis. This occurred particularly in guinea pigs. In rabbits there was found, secondary to the necrosis of the papillæ, a retrodilatation of the tubules, and later cysts lined with flat epithelium. He also observed a connective tissue increase in the vicinity of the lesion.

Lindemann working with Metchnikoff obtained results which were diametrically opposite to Levaditi's. He found the action of the drug to be exerted upon the cortex and not upon the pyramid. The lesions, he found, were principally those of a glomerulo-nephritis. Levaditi explains this difference by the fact that vinylamin is extremely unstable, and has to be used fresh. The material used by Lindemann was sent by Ehrlich and had evidently deteriorated.

It is quite evident that certain drugs or poisons possess a selective action upon the renal papillæ, producing necrosis, sclerosis and secondary calcification and, in certain cases, cyst formation. It is possible that in the case reported, this same process may have occurred. I have been able to determine,

however, nothing out of the ordinary in the patient's routine of life, as regards diet, etc.

Symptoms. In surveying the symptoms referable to kidney cysts, one is impressed with their great variability. Cysts, when small, generally pass unrecognized during life and are usually post-mortem findings. When large, their symptoms depend upon the size, location, the pressure effects, the presence of infection and hæmorrhage.

Pain is very fickle. It was present in about 60% of the cases examined. When present, it ranged from a dull ache to an acute colic, the former being the predominant type. It is generally located in the loin or hypochondrium. Radiation has been very infrequent. Hæmaturia is rare. Lipskeroff's case, which was diagnosed ruptured kidney, was accompanied by profuse bleeding. Jower's case mentioned by Fowler was associated with hæmaturia. Increased frequency of urination has been described only in a few cases. Painful urination is rare. It was present in Hartmann's case. The urine is generally normal in amount. Cysts of large size produce various pressure effects, causing disorders of the gastro-intestinal tract, sensations of weight from the tumor, dyspnœa, weakness and emaciation.

Diagnosis. The diagnosis has seldom been made, even in cysts of large size. Among the diagnoses which have been made are floating kidney (and here should be mentioned that the association of cysts with floating kidney has been observed in a number of instances), hydronephrosis, solid renal tumors, ovarian, splenic, hepatic, omental, pancreatic and mesenteric cysts, and ascites. The urinary findings have in most cases been negative. The cystoscope, ureter catheter and functional tests have usually failed in differentiating the lesion. X-ray has been of little service. However, Wulff made a diagnosis of solitary cyst of the kidney from the X-ray picture and had it confirmed at operation. The tumor, if large, is usually rounded, smooth, dull on percussion, at times fluctuant. The diagnosis of its renal origin depends upon the clas-

sical differentiation of renal tumors from other abdominal tumors; hence, it will not be described.

Pathology. Serous cysts may be single or multiple; they are generally unilateral and situated either in the cortex (Morris) or the medulla (Follin, Duplay, Bouilly, Lancereaux). Terrier believes that the difference is due to the stage of development in which they are seen. He, with Cornil and Ranvier, believes it difficult to specify any elective part. The usual location is at one or the other pole. Terrier reports six cysts of the upper pole out of seven cases. Simon's fifty-two collected cases gave eighteen at the lower pole, eight at the upper pole, eight at different parts of the kidney, such as the anterior surface, posterior border, and convexity.

These cysts vary markedly in size, ranging from a small walnut to the size of a child's head or larger. The case reported by Morris showed a tumor occupying the greater part of the abdominal cavity and weighing sixteen pounds. Englander's case presented a cyst the size of a child's head. Von Brackel obtained two and one-half litres of fluid in his case. Rendu reports a cyst containing ten litres of fluid. Le Dentu believes that the position of the cyst bears a great influence on its size. Those situated in the cortex are usually small, while those in the medulla are generally very large. Sometimes the cysts communicate directly with one of the renal calices. The cyst contents are also quite variable: sometimes clear and transparent; at other times turbid, gelatinous, or caseous. The color ranges from that of water to deep yellow, or occasionally may be bloody. The reaction in most cases is alkaline; at times, acid. Specific gravity, 1010-1020. The chemical constituents which have been found are chlorides, phosphates, sulphates, albumin, serum globulin, cholesterin, urea and water. The presence of urea has created considerable discussion. Many authors, among whom Follin, Duplay, Bouilly, Desnos, say that one never finds any of the urinary constituents in the cysts. However, urea is frequently found, though generally in small amounts. Hæmor-

rhage may occur in the cysts as the result of trauma or extravasation.

Microscopic. The cyst wall widely varies in thickness; it may be thin as paper, or again, considerably thick and firm, and, at times, calcareous. It is composed of dense fibrous tissue, with but few cells (Le Dentu). In certain cases it is composed of stratified layers, more or less adherent (Lamar). Bard and Lemoine think that these layers are due to the fusion of many cysts. Lejars and Sébileau, in their case, describe the cyst wall as being composed of a thick superficial reticulated wall, and a deep wall formed by pushed-up parenchyma in which were thrombosed veins. The cavity is divided incompletely by thickened bands which have an appearance similar to that of heart columns. Terrier has noticed in the external coat canals of different diameters, capillaries full of blood, arteries with endarteritis, and renal tubules. Hyaline changes have been frequently observed in the cyst wall. Unstriped muscle fibers and nerves have also been noticed. Concerning the lining of the cyst cavity, there have been great differences of opinion. Terrier says that wall is composed of fibrous tissue without any epithelial lining, even at the bottom of the folds. According to Follin and Duplay, the wall is formed of a layer of connective tissue whose internal surface is smooth and serous in aspect, and is never covered with epithelium. Lejars has observed many flattened cells, Laveran many thinned-out tubule cells, and Cornil and Babinski, many flat and cuboidal cells. Delkeskamp has seen cuboidal cells lining the cyst. Bonneau and Hartmann report a cyst lined with flat cells containing elongated nuclei, somewhat resembling endothelium. In some places it seemed more like nucleated protoplasmic placques than distinct cells. The lining was not continuous. On the contrary, Lecène has seen the interior of the cysts lined continuously with cuboidal cells. Papin has also observed flat and cuboidal epithelium. Simon says the epithelium is not constant but exists in the majority of cases.

The parenchyma near the cysts has shown various changes. Terrier remarks that to the naked eye, the renal tissue looks normal, but microscopically there are evidences of nephritis. The parenchyma is thickened next to the cyst wall, the juxta-cystic tissue is inflammatory, and the cells of some tubules show a light degree of fatty infiltration. The kidney tissue away from the cyst is normal (Delkeskamp). According to Englander, the tissue around the cyst is thickened, but presents no remarkable changes. The cyst wall has been described as continuing, without a clear line of demarcation, to the normal tissue. Most observers report the tubules near the cyst distorted; some compressed, others dilated, whose epithelium shows granular degeneration. The glomeruli present various changes from the normal to those seen in nephritis. The etiological foundation for the production of the cyst has been theoretical in most of the cases; the origin of the obstruction has not been determined.

Treatment. The treatment of so-called simple or serous cysts of the kidney has varied with the times. In the early days of renal surgery, puncture was a method of attack; either alone, or followed by injections into the cavity. This procedure was uncertain and not without risk. It was generally necessary to make repeated punctures, owing to the refilling of the cyst, and the process was trying to the patient and unsatisfactory to the surgeon. Fouren in 1865 reported a case treated by puncture followed by caustic injections. Iodine has frequently been used as an injection into the cavity after the removal of the contents. With the method of puncture and injection, one runs the risk of having multilocular cysts as a result. Lejars' statistics of seven patients treated by puncture gave three cures and four deaths. Three patients treated by puncture and injection, three deaths. In the light of modern renal surgery, such methods should only be employed in cases of very voluminous cysts to diminish their size so that the removal will become easier. Cystotomy (incision of the cyst) was also an operation performed quite frequently

in the days of yore. It was done either through the lumbar or transperitoneal routes. By the lumbar operation the cyst is exposed, opened, and emptied of its contents. The redundant wall is cut away, the edges then are fastened to the deep layer of the lumbar fascia. The secreting surface of the cyst is destroyed by carbolic or nitric acid, and the cavity allowed to contract and granulate. The transperitoneal method is on the same principle, the cyst is opened, contents removed, edges of the wall stitched to the abdominal parieties, cavity drained and allowed to contract. In some cases, complete obliteration ensues.

The advantages of such methods are that they do not interfere with the remaining kidney tissue and are not accompanied by hæmorrhage. The disadvantages, which have the predominance, are that the wound is slow in healing, is always liable to secondary infection, and the danger of fistula is great. Morris reports five cyst incisions with three fistulæ. Simon reports three cystotomies, one cure, two deaths. Tuffier's statistics show eight cystotomies, six transperitoneal and two lumbar; three were followed by fistula and one required nephrectomy later.

For cysts of moderate size, the most satisfactory method is the one which has been utilized by Tuffier, Bardenheuer, Ricard, Récamier and Albarran, each in one case, namely, the excision of the cyst. In this manner most of the renal substance is preserved and the function of the kidney but little interfered with. In the description of their cases it is noticed, as one would suppose, that the cysts would not shell but required dissection. Concerning this point, the cyst removed by the author differed, as it shelled out easily, required no cutting at all, except in the region of the papilla, where it was cauterized from its attachment to the pelvis. Bardenheuer had to do a secondary nephrectomy on account of infection. Hæmorrhage did not prove alarming in these cases, and it should be no more copious than that following an ordinary

nephrotomy, provided one closes the kidney properly, following the removal of the cyst.

Partial nephrectomy, according to Morris, should be performed if the cyst is situated at one pole of the kidney and a considerable part of the renal parenchyma is spread out over the cyst wall, and if the large renal vessels can be left intact. This operation has held but little prestige and is seldom used.

Complete nephrectomy is applicable to very large cysts, which have destroyed most of the renal substance, and to many cysts scattered in one kidney. Quénu in 1882 reported seven nephrectomies with five cures and two deaths. Lejars in 1889, sixteen nephrectomies: nine cures, seven deaths. Albarran, seven nephrectomies, no deaths. Tuffier collected twenty-four nephrectomies for cysts: thirteen cures and eleven deaths. A glance at the above illustrates a very high percentage of mortality following this operation. The statistics of Albarran are more in accordance with the reports of individual operators of recent date. The improvement is undoubtedly due to more refined technique and to a more thorough knowledge of the functional ability of the remaining kidney.

In conclusion the author desires to delineate and emphasize a few features in his case which seem to be of particular interest in comparison with other cases of a somewhat similar nature that have been previously reported.

As has been the rule in most cases, the diagnosis of the kidney cyst was not made before operation. The diagnosis in this case was renal calculus. In examining the X-ray plates since our acquaintance with the condition, it is very easy to see a shadow, crescentic in outline, in the region of the renal pelvis upon which the diagnosis of stone was made. External to this there is a very faint shadow about the size of a half dollar, which was thought to be an artifact, but which is evidently the cyst wall. It is so faint that reproduction is impossible. The urinary findings at the first examination are easily explained by the fact that no urine was being obtained

from the affected area, the papilla being completely obstructed. There was evidently a compensatory hypertrophy of the remaining renal parenchyma, explaining the normal renal function.

The pathological aspect of the case is very interesting in that the primary lesion, if not unique, is extremely rare, it being a dense papillary sclerosis with incrustation of calcium phosphate confined to one papilla, the other papillæ being, as far as could be determined, in a normal state of preservation. The condition was responsible for the retrodilatation and cyst formation, a process which many authors consider impossible. The other interesting points are that the cyst was entirely confined to the pyramid, there being no cortical substance composing its wall or immediately adjacent to it. The wall of the cyst was firm and dense, contained no remnants of tubules as far as could be determined, nor did it possess any epithelial or endothelial lining. The latter point has been argued by some as refuting the tubular origin of cysts, but it seems without sufficient ground, as one would scarcely expect epithelial lining to be preserved in a cyst having such thick sclerotic walls with poor nourishment. There has undoubtedly been an epithelial degeneration. In the kidney adjacent to the wall, one can trace various gradations of epithelium from tubular to flat, depending upon the size of the cystic space. There was but one large space found in the sections examined which possessed a cubical epithelial lining. This is illustrated in Figs. 5 and 6. The renal cortex, corresponding to the area drained by the diseased papilla, was not thinned out. On the contrary, it was slightly thicker than the remaining cortex; was quite dense and sclerotic, but contained no visible cysts.

The operative features of interest are that the method employed has been utilized, as far as can be determined, but five times previously—by Tuffier, Bardenheuer, Ricard, Récamier and Albarran; and that no trouble was experienced

in shelling the cyst from its bed, as it was completely demarcated from the remaining kidney.

Finally, the author wishes to express his sincere thanks to Prof. Opie for suggestions in the pathological preparation of this paper; to Prof. Shaffer for the analysis of the stone; and to Dr. Downey L. Harris, Bacteriologist of the City of St. Louis for his excellent microphotographs.

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A CLINICAL RESEARCH INTO THE TREATMENT OF UNILATERAL SUPPURATING NEPHRITIS, NOT OF TUBERCULOUS ORIGIN

By William E. Lower, M. D., of Cleveland

TO determine, as far as possible, the best operative method of treating unilateral infections of the kidney, not tuberculous, a clinical research was undertaken with the hope of obtaining sufficient definite data for a guide. Complete reports have been most difficult to obtain as the recent results of the urologists and surgeons of large experience in dealing with this class of cases have not been published, and personal communications requesting a detailed report of unpublished cases was asking more than the busy clinician

should be called upon to do. This research is based on a critical analysis of the published cases, to which is added my own personal experience heretofore unpublished.

The two methods of treatment, nephrotomy and nephrectomy, are generally alluded to as the conservative and the radical. I think that I can show that conservatism as here applied refers only to the saving of the kidney and not to the life of the patient. It has not seemed to me consistent to speak of a " conservative " operation that has a higher mortality than the so-called radical operation.

There should be no two opinions on the operative treatment of unilateral *tuberculosis* of the kidney—nephrectomy should be the rule—but in unilateral infections other than tuberculosis it is necessary to weigh carefully the clinical evidence at our command and see if we can arrive at a conclusion definite enough to be a guidance.

Dr. Samuel Gross (American Journal of Medical Science XCV, p. 79) collected in 1885 statistics from which he drew the following conclusions: "It will thus be seen that of 73 nephrectomies for suppurative lesions from all causes, 41 recovered and 32 or 43.87% died. Of the 93 nephrotomies, on the other hand, 71 recovered and 22 or 23.65% died. It, moreover, appears that of 12 nephrectomies after a previous nephrotomy only 1 or 9.33% succumbed, while of 61 nephrectomies without preliminary incision and drainage, 31 or 50.81% perished. In other words, the mortality of removal of the kidney for suppurative conditions is nearly twice as great as after nephrotomy and a preliminary nephrotomy diminishes the risk of nephrectomy by 41.48%. Hence, we may conclude that a suppurating kidney should never be excised until after the failure of nephrotomy, the only inconvenience of which is that a permanent sinus or urinary fistula remains in 29.57% of the recoveries, either of which may however, should it prove a source of discomfort, be remedied by subsequent extirpation of the shrunken sac, with the risk of only 9.33%. In favor of a preliminary nephrotomy it is

also to be declared that it enables us to determine with almost certainty the condition of the opposite organ."

It must be borne in mind that the preceding was written more than a quarter of a century ago and that since that time advances in renal surgery have been so rapid that many of the arguments are of little value now. Israel and many others have taken a pronounced stand against secondary nephrectomy as being of greater danger than primary extirpation. Also, since the advent of the kidney functional tests, it is altogether unnecessary to perform a nephrotomy to determine the condition of the corresponding organ.

Newman in 1888 in his " Lectures to Practitioners on the Diseases of the Kidney Amenable to Surgical Treatment " collected from literature and his own private correspondence complete lists of the nephrectomies and nephrotomies in infectious cases up to his time. But he considered as recovered patients who had a persistent sinus or fistula—a point which is disputable in spite of the fact that many have sought to show these fistulæ cause no inconvenience to the patient.

Fenger in the Journal of the American Medical Association for March 1894, concluded that nephrotomy was the operation of choice for pyonephrosis. He adds, however, that the disadvantage of nephrotomy lies in the fact that a fistula remains in 45% of the recoveries.

Duret in " Ann. des Mal. des Org. G. U. 1897, XV, 350," reviews a successful case of nephrectomy for calculous pyonephrosis and comes out strongly for the opinion that in calculus simple or multiple, complicated by pyonephrosis, nephrectomy is the operation to be performed.

In 1899 Ransohoff, of Cincinnati, read a paper entitled " Nephrectomy versus Nephrotomy " before the American Surgical Association. In this he said that in acute abscess or pyelonephritis, nephrotomy should be a routine procedure. To substantiate his statement, he spoke of 278 nephrotomies for pyonephrosis, not tubercular, which he had collected; 17 of these were followed by death, a mortality of 21.8%. Of 37

nephrectomies there were 9 deaths, a mortality of 24.3%. Of 17 secondary nephrectomies there were 7 recoveries and 10 deaths, a mortality of 58.8%. Note the contrast in the mortality rate for secondary nephrectomies between Ransohoff (58.8%) and Gross (9.3%).

Kroiss in the Beiträge z. Klin. Chir. 1908, vol. 57, p. 423, has summed up the opinions of most of the European surgeons upon the subject. He speaks of Küster as the principal exponent of the conservative method, who considers nephrectomy justifiable when the substance is entirely or nearly destroyed, or when a stubborn, secreting fistula has existed one or two years. Guyon, Wagner, Albarran and others share his view.

Israel believes in nephrectomy in multilocular pyonephrosis but when the preservation of the kidney warrants it he performs nephrotomy. Garré and Krönlein take Israel's view but Clairmont and Dœring, considering the results of their own cases, can not but feel that nephrotomy in all cases of pyonephrosis is a bad procedure.

Perthes inclines to nephrectomy, basing his argument on Tuffier's experiments, and believes that nephrotomy really leads to the same end: namely, the forfeiture of the operated kidney, the latter only taking a longer time, combined with greater discomforts.

Hildebrand favors nephrotomy and Schmieden, while not rejecting primary nephrectomy, concludes that one must judge the individual case.

The views of the Braun Klinik given by Dœring, (Deutsche Zeitsch. f. Chir. LXXXVII, 1-3, 1907) are to guard against nephrotomy and that primary lumbar nephrectomy is the least dangerous, most certain and quickest method for radical healing.

Chetwood ("Phys. & Surg." July 1905, p. 289) says that Kummel makes it a rule to save the kidney if the ureter is permeable and there appears to be enough renal tissue left. He found, nevertheless, that in Kummel's record of twenty-

three infected cases of renal calculi he performed ten primary nephrectomies, and six nephrotomies required secondary nephrectomy, making sixteen nephrectomies out of twenty-three cases.

Fleming (Glasg. M. J., 1895, xliv, 134) gives in detail the histories of two cases of pyonephrosis with symptoms as nearly similar as possible in the beginning. The first case was drained August 19th, requiring drainage tubes both in front and back on April 29th the following year. At the second operation the kidney was found disorganized and fused with the other tissues. Finally the anterior wound healed May 25th. On July 3d communication had to be made between the two wounds and a tube inserted, after which the patient improved. On January 11th, next year, the sinuses were enlarged and calcareous masses removed. On March 9th the anterior sinus closed but the posterior one still discharged.

The second case had nephrectomy performed on February 18th and the wound was completely healed by March 4th.

He shows the two cases together in order that the contrast may impress the reader with the advantage in future cases of removing an affected kidney at once, rather than first draining and then attempting removal.

Considering the cases of hæmatogenous infection of the kidney, Brewer has proved conclusively in his series of cases the great advantage of nephrectomy over nephrotomy. Bristow (N. Y. St. J. of Med., Aug. 1911) in discussing his cases says that conservative surgery is entirely out of place in this disease. In all cases in which simple nephrotomy was done death resulted but the total number of nephrectomies did well. The reason for this is plain. Nephrotomy reveals but one plane of the affected organ and drains only the abscesses in that plane, whereas, it is a fact that the infection is widespread and can only be effectively treated by total removal. Relief is prompt and permanent upon removal of the offending organ. Cotton (Ann. of Surg., Nov. 11, 1911) in dis-

cussing his cases treated by nephrotomy, says that while his series is too short to warrant positive conclusions, yet it does not seem desirable to him to sacrifice the kidney because part of its substance is gone, if by any safe means the remainder can be saved.

Keyes has summed up the subject in his "Diseases of the Genito-Urinary Organs," 1910, p. 396. He says: "One hears much discussion on the comparative merits of nephrotomy and nephrectomy in the treatment of suppurating kidney. Inasmuch as the question can never be decided one way or another for all cases, the discussion will doubtless continue. But the essence of the matter is this: if adequate ureteral drainage can be established, nephrotomy suffices. Nephrectomy is required when the kidney is so pouched that the urine and pus can not be made to drain efficiently through the ureter, or when its suppuration will do the patient more harm than its secretion will do him good." However, he does not state how we are to determine whether the suppuration will do the patient more harm than the secretion will do him good.

The results of my own cases have led me to favor nephrectomy in most instances. Of my sixty-eight consecutive nephrectomies, without a death, fifteen have been for unilateral infection, not tuberculous. Of my eleven nephrotomies, with two deaths, six have been for infection, with one death. The histories of these twenty-one cases follow in detail at the end of this manuscript.

We have here the opinions of many of the surgeons who have written upon the subject and it will be noted they are much at variance. Most of them concede, however, that a rather large percentage of cases after nephrotomy require a secondary nephrectomy and, according to Ransohoff's statistics, the mortality for this is very high.

The points considered in the classification of cases which is appended to this paper are:

First—The immediate mortality.

Second—The remote mortality.

Third—The period of convalescence.

First—From an analysis of these reports it will be noted that the immediate death rate in the cases classified as complete recoveries is higher after nephrotomy than after nephrectomy by nearly 5½%.

Second—The remote mortality rate for nephrotomies would be represented by that of secondary nephrectomies of which there were 101 (secondary nephrectomies). The remote mortality of nephrectomies would be practically nil if the other kidney was sound, and as we are considering only unilateral infection it is presumed the remaining kidney is sound.

There is no evidence to show that a single sound kidney will not do all the work necessary. On the contrary, there is considerable evidence to prove that being relieved of the handicap of a suppurating mate, a single kidney, even though not entirely sound, will take up the whole work and recover from its own disease, as shown by Israel, who describes a case in which a kidney, the seat of intense septic inflammation, with numerous abscesses, was removed. At the time of operation a severe grade of nephritis was present in the other kidney. After the removal of the abscess kidney, however, all signs of nephritis disappeared. Krotoszyner (Am. Journ. Urol., 1904-05, i, 297) describes a case of pyonephrosis treated by nephrectomy, where the other kidney of doubtful health slowly improved and took up its double burden. Johnson (Med. News, 1902, May 3) tells of a tuberculous infection of one kidney and severe nephritis of the other. Dr. McBurney removed the tubercular organ and all signs of nephritis promptly disappeared.

Keyes in "Diseases of the Genito-Urinary Organs," page 390, says: "One of the most striking features of renal pathology is the compensating hypertrophy of the other kidney. Not only will the kidney do the work of two after nephrec-

tomy, but the merest shell of a kidney, the dense fibrous sac of a pyonephrosis in which the naked eye detects no secreting structure whatever, is still a functioning organ. Its power of excreting solids may be much diminished but its capacity for transmitting water is practically unimpaired. Whether such an organ is worth preserving depends on the integrity of its fellow."

In my own cases I have repeatedly shown that a single kidney will produce a greater output—as measured by the phenolsulphonephthalein test—than both kidneys previous to the removal of the diseased one.

Third—As to the period of convalescence after nephrotomy, we find a large percentage of fistulæ remaining for months and, in many cases, for years (seventy-one cases in this compilation). Certainly no case where a fistula remains could be considered cured. Fistulæ after nephrectomy generally mean an infected ligature or ureter, and are of not very frequent occurrence where the infection is not tuberculous.

In connection with the period of convalescence, it might be of interest to examine a little more closely the post-operative histories of some of the tabulated cases. Thornton's two cases of calculous pyonephrosis (Lancet, 1895, ii, 1041) were treated by nephrotomy; both had prolonged convalescences. In the second case, after two months, a tube had to be reinserted through which pus and urine came. In Miller's two cases of pyonephrosis (Edin. M. J., 1887-88, xxxiii, 1068) treated by nephrotomy, one was followed by death, while the other had a discharging sinus for two years and then died. In Sadler's case of suppurating kidney (Lancet, 1886, i, 919), after the nephrotomy, there was a continual discharge of pus from the loin and although the patient did resume his work in a year he broke down and died of uræmia.

Edel (Arch. f. Klin. Chir., 1887, xxxiv, 423) reports a case of nephrotomy for suppurating kidney where the operation

was performed October 14th. Only on March 25th was the patient able to sit up all day and even after this period of time a fistula remained.

Buchanan reports a case of nephrotomy for pyonephrosis (Med. News, 1898, lxxiii, 306) where a fistula persisted. Later, stones were taken from the wound and more abscesses broken. Finally, nephrectomy was performed and the patient made an uninterrupted recovery.

A. B. Johnson (Ann. Surg., 1890, xxix, 10) tells of one case of nephrotomy for suppuration. In two years the scar discharged pus, abscesses were opened twice, and at last report the wound healed. In another of the same list of cases, the sinus was cleaned later but still persisted. In still another case the sinus had to be enlarged and drained after three years and then the patient died from exhaustion.

Hill's case in the Lancet, 1885, i, 1081, showed the urine again turbid with flocculent pus six weeks after nephrolithotomy. In Ransohoff's case of nephrotomy for infected kidney (Tr. Am. Surg. Ass., xvii, 152), a drainage tube was left in for two and a half years, occasional closing of the fistula giving severe suffering. A nephrectomy was performed and the patient restored to perfect health.

Abbott (Northwest Lancet, 1905, xxv, 34) reports a nephrotomy for a colon bacilli infection followed by a constant temperature of 99 to 100 and the sinus never healed. Secondary nephrectomy was performed and the patient began at once to gain.

In Kummel's thirty nephrotomies for pyonephrosis (Surg. Gyn. Obst., 1907, iv, 21) he had four deaths and twenty-six recoveries. He adds, however, that in the latter there was no permanent improvement.

Chetwood (Phys. & Surg., 1905, xxvii, 289) tells of two nephrotomies for abscess followed by continued destruction of the kidney substance by suppuration so that in both cases after two months nephrectomy was necessary. In a

further analysis of these cases we find 101 secondary nephrectomies and seventy-one fistulæ, surely no encouraging thing for speedy convalescence. In comparatively few cases after nephrectomy does the urine remain entirely free from pus, and in the presence of pyuria no case could be considered completely cured. While it is impossible to lay down any hard and fast rule to govern us in cases of unilateral infections of the kidney, I am convinced from the published cases that we must somewhat alter our nomenclature as to what shall be considered conservative and what radical in dealing with this class of cases.

There follows at the end of this paper a tabulation of 1202 cases of nephrectomies and nephrotomies for infection not tuberculous. The fifteen deaths in which the other kidney was found at post-mortem to be incapacitated have been subtracted from the lists. The conclusions to be drawn are as follows:

	Deaths	Recoveries	Fistulæ	Sec. Neph.	Return of Symptoms
Nephrotomies in Calculous Cases	25 or 18.51%	69 or 51.11%	20 or 14.81%	16 or 11.85%	5 or 3.70%
Nephrectomies in Calculous Cases	25 or 17.48%	114 or 79.71%	4 or 2.79%		
Nephrotomies in Non-calculous Cases	61 or 14.35%	198 or 46.58%	51 or 12%	85 or 20%	30 or 7.05%
Nephrectomies in Non-calculous Cases	73 or 15.08%	408 or 84.29%	3 or 65%		

Combining the total deaths and complete recoveries for both calculous and non-calculous cases we have:

	Deaths	Recoveries
Nephrotomies	86 or 24.36%	267 or 75.64%
Nephrectomies	98 or 15.8%	522 or 84.2%

Following are the deaths and complete recoveries considered by decades:

	1870-1889		1889-1899		1899-to date	
	Deaths	Recoveries	Deaths	Recoveries	Deaths	Recoveries
Nephrotomies	30 or 36.50%	52 or 63.50%	23 or 24.46%	71 or 75.54%	33 or 18.64%	144 or 81.36%
Nephrectomies ...	31 or 27.67%	81 or 72.33%	6 or 7.14%	78 or 92.86%	61 or 14.38%	363 or 85.62%

Case Histories of Nephrectomies for Infection, not Tuberculous

Case 26. *Diagnosis:* Renal calculus.

Operation: Nephrectomy.

Woman, 56 years of age.

Family history: Negative.

Personal history: Showed that she had always been well. Two months before operation, while at work, she was taken suddenly with a desire to urinate, pain very severe extending down into the vagina. Had some pain ever since, at times more severe than at others. Had chills and fever following attack, pain so severe as to require morphine. The pain is better when the patient is lying quietly but is worse when she is moving around. Frequent urination.

Physical examination: Large, tender, movable tumor in left lumbar region.

Urine Analysis: Bladder cells, red blood cells and pus corpuscles.

Catheterization of the ureters: Easily done. Right flowed quickly and naturally. Sp. gr. 1012; some epithelial cells, reaction acid. Left: No flow at first from the ureter; some boracic solution was injected through the catheter and caused a colicky pain in the left kidney region, but no urine flowed. The catheter was passed well up toward the kidney but still there was no flow. Again injection and suction were tried without getting any urine. Finally, I injected more forcibly, producing a paroxysmal colic and incidentally urine flowed. It showed Sp. Gr. 1000, numerous red cells, pus corpuscles, many epithelial cells, reaction acid.

Operation: Nephrectomy of left kidney. Kidney was large and cystic. Upper pole fluctuating. Firmly adherent to diaphragm.

Result: Patient made good recovery. Reported in person a year afterward that she was able to do more than ever before in her life.

Case 38. *Diagnosis:* Renal calculi.

Operation: Nephrectomy.

Woman, 59 years of age.

Family history: Negative.

Personal history: Has 6 children. Has had rheumatism for 20 years.

Present illness: Began 10 years ago with pain in dorsal region. Pain extended over ilium into left inguinal region and has been more or less continuous. At times very intense and cutting in character. At times pain between shoulder blades and in both legs. Lately frequent headaches, appetite good, bowels constipated. Micturition at times frequent and in large quantities, then again scanty and urination difficult, sometimes urine bloody.

Cystoscopy: Very marked injection of bladder over base—great number of trabeculæ.

Catheterization of ureters: Urine flowed from right ureteral catheter freely—none from left. The left catheter was aspirated and injected but no urine flowed. After injection of boracic solution blood appeared in the return solution.

Examination of urine: Right side urine, sp. gr. 1002, many epithelial cells probably from ureter. No pus or blood. Bladder urine sp. gr. 1005. Large number of pus cells, epithelium.

Operation: Kidney of normal size and filled with stones and pus. Large stone weighed 2¼ ounces. Smaller ones ½ ounce, total 2¾ ounces.

Result: Complete rapid recovery.

Case 296. *Diagnosis:* Multiple septic infarcts.

Man complained of pain in the left side for ten days. Personal history negative, excepting that, when a child, he was hurt in the abdomen by falling across a piece of timber.

Present illness: Ten days ago he was taken with severe pain in the left side. This became so excruciating that he was obliged to stop work. He was given an anodyne. Pain subsided somewhat, but recurred a few hours later, more severe

than before. He has not been entirely free from pain since this attack. He was sent to the hospital where he had chills followed at intervals by high temperature.

Physical examination: Showed a well built man with no palpable tumor. Over the left kidney posteriorly was a very tender area. Pain radiated down along the ureter.

Catheterization of ureters: Bladder capacity 300 c. c. Introduction of cystoscope easy. Both ureters readily found and easily catheterized. The orifices about the same in appearance. Right side urine flowed freely. Nothing could be obtained from the left side. Multiple abscesses of kidney and numerous necrotic areas.

Result: Complete recovery in 4 weeks.

CASE 1953. *Diagnosis:* Nephrolithiasis.

Operation: Nephrectomy.

Woman, 47 years of age.

Family history: Negative.

Personal history: Has 5 children.

Present illness: Began about one year ago by swelling of the feet. Also found that she grew tired much more quickly than formerly. Had some heaviness on the right side, no vesical symptoms. For some time she had noticed a tumor which could be moved around in the right side. This was diagnosed by the attending physician as probably a floating kidney.

Examination: She had marked prolapsus of the uterus, which has been present since the birth of her youngest child, six years ago. In the right side is a palpable, movable tumor very hard, which can be pushed up under the ribs and is undoubtedly a kidney.

Cystoscopic examination: Bladder capacity 300 c. c. The introduction of the cystoscope is easy, but on account of the very marked cystocele the ureters were difficult to find. Both were located and catheterized. Urine flowed quite freely from both sides. The left appeared about the color of normal urine while the right was white and flocculent. The right side

stopped for a while, then started again and flowed very rapidly.

Examination of the specimens: Right, freezing point —0.54; reaction, acid; negative for sugar; very heavy percentage of albumin; full of pus cells; no bacteria showed on stained slides.

Left, freezing point—1.58; reaction, neutral; sugar, negative; albumin, faint trace; numerous transitional cells; some hyaline casts, a few cylindroids, red blood cells, occasional white cells, uric acid crystals.

Operation: Oblique incision along the border of the 12th rib, separating the muscles and exposing the kidney. The kidney being rather large, the wound was enlarged by cutting the muscle. Kidney very movable and easily delivered. It was soft and crepitated and in the pelvis was a hard mass, undoubtedly a stone. All calices were full of a grating mass of pus and stone. The kidney looked to be functionless and so was removed.

On opening the kidney it was found to contain a very large stone which filled the entire pelvis and small ones in the dilated calices.

CASE 2490. *Diagnosis:* Left pyonephrosis.

Operation: Nephrectomy.

Woman, 39 years of age. Complains of pain in the left side.

Family history: Negative.

Personal history: Has had usual diseases of childhood. Usual health excellent. Has one healthy child. Normal labor. Had dilatation and curettage and hæmorrhoid operation 10 years ago. Used morphine for a year after the operation.

Present illness: Patient first noticed pain in left side eight years ago. The attacks of pain have come about once a year. Have been associated with pyuria. The pain would gradually become worse for several days when the patient would pass considerable pus and obtain almost instantaneous relief. During the attacks the patient was feverish and

nauseated. Suffered with headaches. Passed but a small amount of urine. The passage of pus in the urine has always brought a year's respite. Patient has lost 50 pounds during the time of her sickness.

Physical examination: Showed a fairly well developed woman, somewhat emaciated, free from pain as she lies quietly in bed. General condition good. All the left side and the epigastrium tender to pressure with muscular rigidity. About the left kidney there is increased resistance which extends down to Poupart's ligament.

Catheterization of ureters: Bladder capacity of 60 c. c. Introduction of cystoscope easy. Bladder much inflamed. Left ureteral opening pouting. Both sides catheterized. Urine coming from right side quite clear. Nothing from left. Examination showed few leucocytes in the right side urine.

Operation: Patient received usual preoperative preparation. Gas anæsthesia. Incision 12 cm. long and curved to follow the border of last rib made in loin region and carried down to the kidney, which was found to be hard, irregular and nodular. Opening enlarged. Vessels clamped at pelvis and kidney removed. Hæmorrhage controlled and wound in kidney closed by running buttonhole sutures of chromic catgut. Closure of the muscular wall in layers with chromic catgut. Silkworm gut in the skin. Five interrupted stitches. Iodoform gauze and cigarette drain in place. Moist bichloride dressings. Returned from operating room in good condition.

Result: Recovery.

Pathological report: Specimen of kidney tissue shows changes of chronic inflammation and consists partly of fibrous tissue with fatty tissue interspersed with areas of beginning calcification.

Microscopical examination: Sections show a condition of multiple abscesses situated especially in the upper pole of the kidney and connecting with the pelvis of the kidney.

Diagnosis: Multiple abscesses of the kidney.

CASE 2657. *Diagnosis:* Calculous pyonephrosis.

Operation: Nephrectomy.

Woman, 40 years of age. Complained of pain in right side.

Family history: Negative.

Personal history: Showed children's diseases. Several attacks of tonsillitis. Frequently painful menstruation lasting 6-7 days. Five children, all living and well. No miscarriages. Ten years ago had dilatation and curettage and double salpingo-oöphorectomy.

Present illness: Eleven years ago began to suffer with severe attacks of pain in right flank. Came on suddenly with extreme severity. From time to time since then has had similar attacks but not of such severity. Lately the attacks have been more severe. Formerly had intense pain in the neck of bladder when urinating, but has not had this lately. Gets up three or four times a night to urinate.

Physical examination: Patient is a well nourished, well developed woman. Seems rather apathetic. Liver and spleen not palpable. Lower pole of right kidney palpable on deep pressure and tender. Left kidney not palpable. General tenderness on pressure over lower half of abdomen. In the back there is marked tenderness on pressure below the costal margin on the left side but not on the right.

Cystoscopy: Bladder capacity 300 c. c. Bladder much inflamed. Both ureters catheterized. Turbid urine obtained from right side, clear from left.

X-ray picture shows large stone in the right kidney.

Operation: Usual preparation. Gas anæsthesia. Lateral position. Oblique incision carried through muscle and fascia. Fatty capsule dissected away. Kidney delivered, pelvis incised. Large calculus removed. Kidney opened by lengthwise incision with renal arteries clamped. Calculi removed from calyces. Considerable destruction of renal tissue. Kidney excised. Ureter ligated. Cigarette drain inserted. Skin closed with silkworm gut.

Post-operative: Considerable pain and vomiting. Good recovery. Discharged well.

Pathological report: Specimen is that of a right kidney, measuring 4 by 2¼ by 1 inches. The surface is slightly hæmorrhagic, the capsule being somewhat adherent. Pelvis much dilated and shows numerous places where stones were present. The cortex in places is very thin, especially so over the stone cavities. The blood vessels of the cortical substance are somewhat distended. Blocks consist of cortex. Extending along the tubules long chains of pus are present. Here and there small collections of pus cells are present, constituting small abscesses in the cortical substance.

Case 2715. *Diagnosis:* Pyonephrosis.

Operation: Nephrectomy.

Woman, 21 years of age. Family history negative. Had most of the diseases of children.

Present illness: Began about 6 months ago with pain in the bladder attended with fever. Next morning urine was very cloudy. Patient was in bed for several weeks. Three months ago began to notice dull pain in left hypochondrium. Treated with hot applications. Urine very cloudy since. Has to void frequently, passing small amounts. Passed blood clots at different times. Massage in left kidney region causes urine to become very cloudy and relieves pain in kidney. Has lost much weight. Has night sweats occasionally, but rarely cold sweats.

Physical examination: Patient a poorly developed, poorly nourished woman, of nervous disposition, but normal mentality. Abdomen is tender in left hypochrondium and in left groin.

Cystoscopy: The entrance to left ureter is inflamed and pus is discharging from it. Right, normal in appearance.

Operation: Usual preparation. Right lateral position. Incision parallel to costal border in left loin. Left kidney delivered, vessels at base clamped and organ removed. Vessels tied off with silk. Ureter stump ligated, touched with

carbolic acid, then with alcohol; closure of the wound with chromic catgut in muscle; interrupted silkworm gut stitches in skin. Drainage with cigarette drain and iodoform gauze. Hot bichloride dressings.

Patient made an uneventful recovery.

Pathological diagnosis: Pyelonephritis.

Kidney measures 9 x 3.5 x 4 cm. Ureter markedly thickened and exudes pus. Pelvis is a mass of inflammatory tissue, capsule strips easily and is not thickened. Upon section, consistency is slightly increased and pus flows freely from numerous abscesses, which by their communication have left little of the kidney but the cortex. The cortical substance is pale, greasy, and apparently contains no blood. Pus has no odor.

Microscopical examination: Capsule wanting. Very marked parenchymatous degeneration is seen throughout. Cells are granular; tubules filled with blood and tissue *débris;* glomeruli in some instances scarred, in others wanting. In many places the kidney parenchyma is the seat of marked purulent changes so that it is unrecognizable. Small abscesses are seen in various areas, more pronounced toward the pelvis. The vessels are thickened and lymph channels filled with polymorphonuclear leucocytes.

Case 2751. *Diagnosis:* Pyonephrosis.

Operation: Nephrectomy.

Man, 45 years of age. Complained of pain in the left side. Patient had been treated for chronic cystitis and discharged improved. The cystitis was of unknown etiology, no organisms being grown from the urine. The patient complained of pain in the right side extending down the thigh.

Present illness: Had been in the hospital twice for treatment of cystitis by irrigation, the last time being discharged well. Six days before entering the hospital the third time, he was seized with severe pain in his left side, radiating down the thigh. Renal colic was diagnosed and a radiograph of the left kidney made. This showed a small round stone in the

bladder but by the time the radiograph had been developed the stone had passed *per urethram.* After this a radiograph of the right kidney was made showing numerous calculi.

Physical examination: Showed a well nourished, well developed man. Spleen and kidneys not palpable. Abdomen soft and symmetrical, no muscle spasm, tenderness, masses or free fluid. Some tenderness in right costo-vertebral angle.

Cystoscopy and ureteral catheterization: Small quantity of slightly cloudy urine from right side. About twice that amount of clear urine obtained from the left ureter in the same time. Bladder capacity 150 c. c.

Operation: Lateral position, incision made obliquely downward and outward from beneath the last rib in the right side. Kidney exposed but ruptured almost immediately; its walls being very friable. A considerable quantity of purulent urine was discharged from the ruptured kidney. Curved clamps were applied on kidney vessels and the ureter and the kidney excised. The stump of ureter was found to be widely dilated, containing several small calculi. These were removed and gentle efforts made to pass a probe into the bladder through the dilated ureter. This did not succeed, but, as the ureter was apparently free from any more calculi, it was left intact. A cigarette drain was inserted, kidney vessels were tied with heavy linen. Wound closed by tier sutures, catgut being used for the muscles and silkworm gut for the skin. The patient stood the operation well.

The kidney was a thin walled sac, very little kidney substance remaining, containing some soft granular substance, evidently pieces of stones, but no large stones.

Patient discharged well. Lost 30 pounds while in hospital.

Bacteriological report: (By Dr. Ladd.) Two organisms, one closely resembling sarcinæ. Is very resistant to heat, as cultures taken after usual amount of autoclaving, grew out.

Pathological diagnosis: Chronic suppurative nephritis.

Bacteriological report: Staphylococcus.

Section of kidney: Glomeruli and tubules are thickened and swollen; actual destruction of cells is noted in many places, while in others the fissures are markedly infiltrated with round and pus cells. Many capillaries and arterioles show obliterative thickening of their walls.

Swab: Staphylococcus.

Result: Recovery rather slow. After leaving hospital took a long vacation and returned to business feeling well. About one year after operation, he contracted a cold and had complete suppression of urine and died five days after. Autopsy showed a large white kidney.

CASE 3043. *Diagnosis:* Stone in right kidney.

Operation: Nephrectomy.

Man, 54 years of age. Has always had good health.

Family history: Negative, excepting that one sister died of tuberculosis after a typhoid fever. Has three children.

Present trouble: Twenty-eight years ago, had first renal colic. Fifteen years ago, began to have more or less soreness on right side. Seven years ago, passed a small stone about the size of a pea. At present is very tender over the kidney and so sore that he is unable to work with any degree of comfort.

X-ray picture reveals calculus in right kidney.

Operation: Right oblique incision along the lower border of the 12th rib, exposing the kidney. In the pelvis of the kidney was found a small stone about the size of a hickory nut. In bringing up the kidney the pelvis was ruptured by the stone forcing its way through. The pelvis was so brittle that it could not be sutured and as the kidney was distended with purulent urine, it was removed. Vessels tied off with linen. Drainage.

Result: Fistula persisted for several months due to an infected ligature.

CASE 3391. *Diagnosis:* Chronic pyelonephritis.

Operation: Nephrectomy.

Man, 22 years of age. Complained of pain in right side. Mother died of tuberculosis. Father and sister living and well. Personal history of childhood diseases and deafness in right ear, having a discharge from ear about five years ago.

Present illness: Began about 17 years ago. Had severe pain in bladder, then passed blood. An operation gave relief until he was about 12, then had pain in bladder again, was reoperated and was relieved until about one year ago when he had pain in right side. Was treated for six months without improvement.

Ureters catheterized: Clear urine flowed from the right side and no urine from the left.

Operation: Patient in left lateral position. Incision 10 cm. long parallel with erector spinæ in posterior axillary line, between 11th rib and iliac crest. Superficial vessels clamped and tied with catgut. The perirenal fascia was very adherent to the renal capsule. After breaking up these adhesions, the kidney was delivered through the incision by means of kidney forceps; the upper pole was soft and fluctuating. The renal vessels were clamped and tied with linen. The capsule of the kidney was not especially adherent to the organ. The kidney was somewhat contracted, presenting a bluish congested appearance and seemed to be softened in consistency. The ureter was clamped and ligated with plain catgut. The pelvis of the kidney ruptured during delivery. The end of the ureter was cauterized with pure carbolic acid and was then dropped back into place. Cigarette drain.

Result: Following the operation there was a gastro-mesenteric ileus, stomach being very much dilated. Stomach lavage greatly improved this condition.

Bladder irrigations with boracic and 4% argyrol increased his comfort. Had some occasional, unlocalized, pain. Discharged in good health, excepting for a small fistula which soon closed.

Pathological report: On examination an abscess was found in the upper pole of the kidney. The parenchyma was very thin in some places measuring less than 1 cm. The pelvis was enlarged and dilated.

Examination of a microscopical section shows an inflammatory condition of a chronic nature, which is apparently due to an ascending infection. The pelvis shows an erosion of the epithelium in places and an infiltration of the interstitial substance of the medulla by lymphocytes. These have undergone karyokinesis, and the chromatin, while staining deeply, is granular. The tubules show some cloudy swelling, especially marked with loops of Henle and the straight tubules. In the cortex there is a marked congestion of the blood vessels, which may be post-operative. The glomeruli appear to be normal although their congested condition has swollen the tufts so as to completely fill their capsules. A small area of round celled leucocytes was noted near a vessel, which is probably a lymphatic focus. No evidence of tubercles could be noted. A section stained for tuberculosis bacilli proved to be negative.

Case 3466. *Diagnosis:* Renal calculi.

Operation: Nephrectomy.

Woman, 34 years of age. *Family history* shows apoplexy, cancer and kidney trouble. Patient has had usual diseases of childhood; otherwise was in good health. At 19, had operation for cysts of the ovary. Married 10 years ago. Eight years ago came to the hospital after an abortion and had a dilatation and curettage. The bladder was also infected and it was irrigated. Two years ago had both Fallopian tubes removed. Patient has passed quantities of gravel.

Present illness: Patient has not felt well for a year. Has complained of weakness, and pain in back. She has no strength or ambition. Whenever she catches cold she has pain in the right kidney region for days. The urine increases in amount and contains pus for a week after the pain.

Physical examination: Showed a well developed young

woman. The right kidney is palpable and very tender. There is much tenderness in lower quadrant of the abdomen.

X-ray examination shows a large right kidney with 5 or 6 stones, ranging in size from a bean to a hickory nut.

Catheterization of ureters: Bladder capacity 300 c. c. Introduction of cystoscope easy. The ureteral openings easily found. They seemed normal. The catheters passed without interruption to the pelvis of the kidneys. Urine flowed immediately and freely from the left side, but was considerably delayed from the right side. The left urine was clear and the right turbid.

Phthalein appeared on the left side in 5 minutes, on the right only faintly in 16 minutes.

Operation: Usual preparation. Incision 15 cm. long made diagonally across right lumbar region. The kidney was exposed and found to be enlarged, cystic and fluctuating; filled with stones and pus and removed.

Result: Recovery in 3 weeks.

Post-operative phthalein test: Drug appeared in 5 minutes.

1st hour output	50%
2d hour output	30%
	80%

Case 3467. *Diagnosis:* Pyonephrosis.

Operation: Nephrectomy.

Man, 21 years of age. Complained of bladder trouble. Family history negative. Patient had always been well. Had gonorrhœa 18 months ago after the onset of the present illness.

Present illness: Three years ago, after " catching cold," he first noticed an increased frequency of urination and a slight burning sensation on voiding. The urine was slightly cloudy but no blood was passed at this time. He voided every two hours, urination gradually became more frequent.

The gonorrhœa 18 months ago did not alter his bladder trouble.

Six months ago he began to void every 30 minutes, micturition being accompanied by very severe pain and blood in urine. The patient has been gradually getting worse; he now voids a small amount every 10 minutes. Pain very severe. Has lost weight.

Physical examination: Patient is a somewhat undernourished man. Muscular development only fair. The right kidney seems enlarged, the lower pole can be grasped. Some tenderness over the bladder region.

Cystoscopic examination: Bladder very irritable. Does not hold much more than half an ounce. It is red and contracted, also inflamed. There is a diverticulum on the right side posteriorly, one ureter empties into it. Because of the extreme irritability and position of the ureter it was impossible to do a ureteral catheterization.

Operation: Usual preparation. Lateral position. Long incision in left loin parallel to lowest rib. A very large, tense, blue kidney was exposed. The other kidney, examined by passing the hand through the abdominal cavity, was smaller and firmer. The left kidney was aspirated and a large quantity of thick yellow pus drawn off. The kidney was then removed after clamping of renal vessels and ureter. The peritoneal opening was closed previous to opening the kidney. Two cigarette drains and one iodoform drain inserted. Muscles closed with chromic gut and skin with silkworm gut. Patient returned from the operating room in fair condition.

Result: Convalescence interrupted by diphtheria, but returned to perfect health gradually.

Pathological diagnosis: Acute suppurative nephritis.

Microscopical examination: Section shows marked inflammatory process. Numerous pus and round cells almost obliterated the kidney substance. No tubercle bacilli.

Case 3468. *Diagnosis:* Pyonephrosis.

Operation: Nephrectomy.

Man, 60 years of age.

Family history: Shows some genito-urinary diseases.

Personal history: Patient had always been well. One year ago had acute retention of urine and had to be catheterized. This attack lasted two days. The physician at this time discovered enlargement of the prostate. During the summer had an attack of sudden, sharp pain, starting in the left loin and radiating down the course of the ureter. The pain caused him to faint and fall to the floor. Pain lasted only a few minutes and no hæmaturia followed. Four weeks before entering hospital had another attack of acute retention and had to be catheterized several days.

Present illness: Began two weeks ago with chills, fever, and temperature of 104. Pain in left loin of aching character. Pain did not radiate. No blood in urine and only a few pus cells. This condition continued for 3 or 4 days when his physician noticed an enlarged and slightly tender left kidney, which kept increasing in size until the day before entering hospital, when hæmaturia occurred coincident with a decrease in size of kidney. Patient has noticed pain in left kidney only a few days. When voiding there is a severe griping pain along the course of the left ureter. Slight blood in urine. Increased frequency of micturition. Patient has lost about 30 pounds in weight.

Physical examination: Patient is a well developed, sparsely nourished man. No masses in right half of abdomen. Left kidney much enlarged.

An X-ray picture shows no stones.

Cystoscopic examination: Bladder capacity 300 c. c. Urine from right ureter clear. Left ureter could not be catheterized because of projection of left lobe of prostate beyond ureteral orifice.

Urine analysis: Catheterized specimen from right kidney clear except for occasional leucocytes. Mixed specimen from bladder loaded with pus.

Operation: Usual preparation. Right lateral position. S-shaped incision in left lumbar region about 20 cm. long, dividing skin, fascia and muscles. Fat around kidney thickened and œdematous. Kidney delivered with some difficulty from capsule; in doing this small pockets of pus were opened up. These were evident all over the kidney. Renal vessels and ureter clamped and kidney removed. Vessels tied with heavy silk. Cigarette drain. Closure of wound. Patient stood operation well.

Result: Recovery attended by some suppuration of the wound and some pus in urine. The sinus eventually closed.

Pathological diagnosis: Acute suppurating nephritis.

Organ enlarged. Numerous yellowish areas visible under the capsule, in many instances conglomerate.

Smears show many intracellular diplococci, varying considerably in size. No tubercle bacilli.

Microscopical examination: Staphylococcus albus in pure culture. Various degrees of degeneration and necrosis of parenchyma throughout the gland. Marked inflammatory infiltration and abscess formation.

CASE 3469. *Diagnosis:* Chronic pyonephrosis and cystitis.

Operation: Nephrectomy.

Woman, 36 years of age. Ten years ago had seven stones removed from left kidney. Had had more or less trouble ever since.

Operation: Routine preparation. Diagonal incision on the left side. Kidney exposed and brought into wound. Ureter cut and treated by carbolic acid and alcohol. Renal blood vessels were very small. The kidney was only a shell with very little substance left. It contained several stones. The vessels were ligated and the wound drained. Patient left operating room in good condition.

Post-operative treatment: Vesical irrigations with boracic solution.

Result: Discharged well in three weeks.

Later report: Patient in perfect health.

CASE 3470. *Diagnosis:* Nephrolithiasis.

Operation: Nephrectomy.

Man, 34 years of age. Complained of pain in his left side.

Family history: Showed one grandfather died of "kidney trouble." No tuberculosis or cancer. Been married 10 years.

Personal history: Usual diseases of childhood. Bronchopneumonia 4 years ago. Often troubled with "sour stomach" after meals and with nausea and vomiting, more particularly when he had this pain in the right side. No jaundice. Bowels constipated.

Present illness: Began 4 years ago with attacks of sharp, cutting pain in left side, sometimes shooting down into the bladder. Pain lasted about 2 days, coming at intervals of 2 weeks to 3 months, then patient was practically free for 3 years.

During the past year, however, the attacks have recurred, coming with increasing frequency and severity, more often when the patient is much on his feet. The attacks begin with a feeling of fullness in the bladder and an aching sensation in the left testicle and later a severe aching sensation in the left lumbar region. The pain lasts from 6 to 24 hours, requiring strong sedatives for relief. Patient says blood has been found in urine microscopically. No change in weight, strength or health in general during the past year.

Physical examination: Patient a well nourished adult. Abdomen shows no distention or movable dullness; no masses seen or felt. Patient somewhat tender on deep palpation in left renal region, also downward along left ureter and over bladder.

X-ray picture shows numerous stones in left kidney.

Catheterization of ureters: Bladder capacity 300 c. c. Introduction of cystoscope rather difficult on account of tight prostatic portion of urethra. Both ureters found and catheterized, but solution became so warm that the catheters became soft and would not advance. Further attempts discontinued. Two days later a second attempt was made and

both ureters catheterized; purulent urine from left side, clear from right.

Phthalein test showed color from right side in 4½ minutes and from the left in 10 minutes. The amount of the drug from the right kidney was 18% and from the left 2.5%. The urine was collected for 15 minutes only from ureteral catheters. Intravenous phthalein injection.

Operation: Through the lumbar subcostal incision the left kidney was exposed without resection of the rib. It was surrounded by an immense quantity of perirenal fat which had to be partially removed. The kidney was then delivered and the pedicle surrounded with dry tape. On account of the renal capability test and the gross appearance of the kidney it was deemed unwise to open it. The pedicle was clamped securely and the kidney excised. Ureter stump treated with carbolic acid and alcohol. Vessels ligated with silk. It was decided to leave the stones in the lower ureter on this side undisturbed, believing they would not cause any disturbance.

Closure with chromic catgut for the muscles and fascia, silkworm gut for the skin. One large cigarette drain to renal fossa.

Result: Recovery. Complete in three weeks.

Post-operative phthalein test: Amount collected, 1st hour 500 c. c., sp. gr. 1006, and drug excreted 45%; 2d hour 140 c. c., sp. gr. 1008, amount excreted 9%. Total drug excreted 54%.

Case Histories of Nephrotomies for Infection, not Tuberculous

Case 105. *Diagnosis:* Pyonephrosis.

Operation: Nephrotomy.

Man, 49 years old. Complained of pain in the left iliac and inguinal region, radiating to left leg.

Family history: Father died of lung trouble. Mother died at time of menopause. Three brothers well.

Personal history: Shows that the patient has had rubeola, parotitis and variola. Also typhoid fever. Has had bladder trouble.

Present illness: Pain started suddenly one night causing great discomfort. The urine was bloody after the attack. Pain was also referred to the glans penis. The attack was followed by a marked chill. Pain is not periodical.

Examination: Shows bladder very much inflamed over the base. The ureteral openings were in the midst of areas of inflammation. The right ureter was catheterized but the light burned out before the left could be catheterized. Urine from the right kidney showed a large number of pus cells, few red cells. A very large mass could be felt in the left hypochondriac region.

Operation: Nephrotomy was performed but the patient died on the fourth day from general sepsis.

Case 1661. *Diagnosis:* Pyonephrosis.

Operation: Nephrotomy.

Man, 25 years of age.

Present illness: On Dec. 5, 1903, went to bed with aching in perineum and scrotum, especially marked on left side. The preceding week on Tuesday, had an acute attack of dysentery. Thursday went to a football game and was thoroughly chilled. Sunday first noticed pain in pelvic region and thighs, with slight fever and chills. This passed away but in a few days the patient began to notice aching in the left cord and around anus. From the 5th on had acute, spasmodic pain at the neck of the bladder. By the 23d the pain had ceased, but nightly priapism has always continued and still now exists to some extent.

Was seemingly well during January until the 29th, when he suddenly became ill with high temperature, chills and pain in the left side. The pain disappeared in 24 hours, the fever in 7 days. One day intermission and then a similar attack lasting 4 or 5 days.

After 2 weeks an abscess developed in the left shoulder, and he had a slight rise in temperature. The abscess was opened in a few days and healed promptly. Then two more on left leg began but were aborted by the use of heat. Just as they disappeared the patient again had fever, which lasted several weeks, going as high as 105, during which he had frequent attacks of severe pain in various parts of the abdomen. Convalesced, but in a few days had a recurrence. The entire summer was passed with these recurring attacks. The fever, however, finally disappeared, the temperature falling to subnormal, going as low as 94. Appetite poor, nausea after eating, rarely vomiting.

During June and July there were attacks of excessive perspiration, cold sweats, coming on early in the morning and passing away later in the day. These stopped about the 1st of August.

October and November found the patient very weak, eating practically nothing, drinking very little, if any, water, but an occasional cup of coffee. Pulse about 44, temperature 95.2. Urine averaging from 8 to 12 ounces in 24 hours. November 1st weakness and dyspnœa were so great that he was forced to stay in a chair day and night in order to breathe. November 12th he was troubled with nausea and diarrhœa, with little control or expulsive force. No appetite. Took about 5¼ grains of morphine a day. Slightly improved the last of November. Tried hyoscine with little benefit.

On the 29th he had a convulsion, followed by an hour's loss of consciousness. Vomited bile, was very drowsy and complained of headache. Specimen of urine showed a specific gravity of 1006; very little pus. Total quantity in 24 hours, 30 ounces.

December 1st, respiration low, 6 to 12 per minute; pulse 44, temperature 97, nervous and restless; total amount of urine in 24 hours, 12 ounces.

December 5th, total amount of urine 8½ ounces, but the patient is feeling better. Since then a more or less steady

improvement took place, as evidenced by an increase in urine and a decrease in daily amount of morphine.

On November 5th his weight was 78 pounds; December 10th, 83 pounds, and has been increasing rather steadily at the rate of a pound a week.

December 19th, weight 85½ pounds, total amount of urine 32 ounces; patient is sitting up. Good appetite, but constipated.

December 25th, began to feel worse, pain in left side, drowsy, total amount of urine 17 ounces.

January 1st, still pain, trace of albumin, no pus, total amount of urine 30 ounces. January 3d, began slowly improving again. February 18th, pain in left side, weight 90 pounds. February 22d, total amount 26.5 ounces, specific gravity 1012, small quantity of albumin and pus.

Cystoscopy and ureteral catheterization: Bladder capacity 300 c. c., after introducing the cystoscope very free bleeding occurred, but one could get a fairly good view of the bladder, which was clear, excepting over the trigonum; this was much inflamed.

Catheterization very difficult; finally from the wave caused by a spurt of urine the right ureteral orifice was located and catheter introduced. Could not find left. Urine flowed slowly, could obtain only about 4 c. c.

Examination: Reaction acid; albumin, no casts—epithelial cells from ureter. Occasional leucocytes. Culture showed streptococci in pure culture and short chains.

Three guinea pigs were inoculated. The first died 18 days after inoculation, cultures from spleen and heart's blood gave pure culture of staphylococcus aureus. The second animal died 4 days after inoculation. Cultures showed paired cocci probably pneumococci.

All three animals remained negative for the tubercle bacillus.

Operation: Operation March 2d. Anæsthetic ethyl chloride and chloroform. Oblique incision along lower border of

last rib on left side. Unable to find any perinephritic fat or anything that resembled a kidney. Peritoneum opened and finger placed within the peritoneal cavity and exploration made but nothing that gave the shape or consistency of a kidney could be felt. Well up under the ribs, pressing upon the diaphragm, was a mass of fibrinous tissue. Dissecting this free a quantity of pus was evacuated which seemed to exude from the upper part. Iodoform gauze drain, both in cavity and shutting off the peritoneum. Saline solution. Patient left table in fairly good condition.

Result: Good operative recovery. Two years later was operated upon for a post-operative hernia. At that time the region of the kidney was explored but no kidney could be found.

Case 1831. *Diagnosis:* Renal calculi.

Operation: Nephrotomy and drainage.

Man, 42 years of age.

Family history: Negative.

Personal history: Patient could remember no childhood diseases. Thirteen years ago he had gonorrhœa for 4 weeks. Had an operation 4 months ago for supposed gallstones, but none were discovered and the appendix was removed.

Present illness: Has been sick at intervals for the past 8 years. Patient has suffered pain over right kidney, followed by vomiting. The pain at first was dull, referred to front of abdomen over the gallbladder. At present the pain is sharp and cutting and localized to the region of the right kidney. Never experienced any pain in act of urination or along the course of the ureters. Never observed any blood in urine but has noticed that its color varies from light to dark. Patient urinates 3 or 4 times per day and an equal number of times at night. He has lost 12 to 15 pounds. Appetite poor, bowels regular.

Operation: Incision made parallel to lower border of twelfth rib on right side in lumbar region. The kidney could not be dislodged through the incision so the twelfth rib was

fractured. The kidney was partially delivered and the vessels compressed by gauze and finger pressure. The kidney was opened and three stones were removed. The kidney was then partially closed and a drainage of iodoform gauze left. The external wound was closed with silkworm gut.

Result: Recovery with sinus for several months.

Case 2025. *Diagnosis:* Nephrolithiasis.

Operation: Nephrolithotomy.

Man, 29 years of age.

Complaint: Renal colic.

Family history: Negative.

Personal history: Had mumps. No other diseases of childhood.

Present illness: Began on the right side about 6 or 7 months ago. Pain dull and aching in character. Pain lasted only an hour at a time on 2 successive mornings. Two weeks ago began on left side, but severe pain soon disappeared, leaving a soreness on this side. Severe pain then came on right side. Hot applications gave no relief so he was sent to the hospital on the twelfth day.

Two days before operation he passed 16 ounces of urine. Could not get any urine by catheter. No urine passed until time of operation.

Operation: Oblique incision along the border of the right twelfth rib. Kidney exposed, surrounded by a large mass of fat, the patient being unusually corpulent. The kidney was very much enlarged and engorged. It was brought into the wound and bisected. Near the upper pole was a small calculus and surrounding this an ulcerated area, as though a large calculus might have left this point and worked its way out. The ureter was much dilated but so far as it could be palpated no stone was detected. To control the hæmorrhage a large curved intestinal clamp covered with rubber was used to compress the vessels. This absolutely controlled the hæmorrhage during the cutting of the kidney. It was then released and the bleeding points noted and tied. The tem-

porary clamping did not seem in any way to interfere with the circulation when the clamp was released. Kidney was packed with gauze and iodoform gauze packed around it.

Result: The same afternoon the patient began to secrete some urine, and after that secreted from 20 to 30 ounces per day, a considerable amount coming through the dressings.

Showed jaundice on the fifth day. No hæmorrhage when the packing was removed. Was more or less nauseated after the operation, and did not retain saline irrigations by bowel comfortably.

After leaving the hospital he was able to be up and about, the fistula still discharging considerable urine and pus. Gradually the urine ceased to be drained through the fistula, his temperature rose, he secreted less and less urine. Nearly 4 months after the operation he had total suppression.

He was sent to the hospital and under cocaine the kidney was entered through the fistula. There was considerable bleeding. By palpation no more stones could be detected. Wound packed with iodoform gauze. The day after he secreted only about 90 c. c. of urine. Gradually the fistula became smaller, opened and closed several times. He reported 14 months after the second operation that the fistula had been closed 6 weeks.

Case 2168. *Diagnosis:* Infected hydronephrosis.

Operation: Nephrotomy.

Man, American, 38 years of age.

Family history: Negative.

Personal history: The patient had malarial fever 30 years ago. Urination negative up to 7 years ago. Had gonorrhœa, a prolonged case followed by stricture, 20 years ago. Had syphilis 7 years ago and was treated for 4 years. Used whiskey and tobacco.

Present illness: Seven years ago, patient was compelled to retain urine for a long time and when the bladder was emptied, he was seized with a sudden, sharp, stabbing pain in the right kidney region. This lasted but a few minutes.

Following and until 6 months ago he had sharp pain after every urination. Three years ago he began to have bladder trouble. He passed bloody urine for a year intermittently, when he had definite cystitis and at times would pass "almost pure pus" and occasionally would have retention followed by passage of "plugs of mucus."

Six months ago he began to have a steady pain in the right kidney region. At times he would have chills followed by fever. Pain, at times very severe, followed by the passage of very purulent urine. The "lump" in his side was larger. For the last 6 months instead of urination being followed by pain it would generally bring relief.

Four months ago he became very weak and has been practically confined to bed ever since.

Physical examination showed a well developed man, but rather poorly nourished. No distention of abdomen but considerable general tenderness and muscular rigidity throughout, on palpation, most marked in the right hypochondrium.

Operation: Under gas anæsthesia, lumbar incision close to and parallel with twelfth rib. Incision made into kidney and a large amount of yellowish pus having fæcal odor escaped. The kidney was a mere shell enclosing an abscess. The pockets of pus were broken into with the finger. Rubber tube and cigarette drain placed to the bottom of the cavity. Edges of the wound packed open with iodoform gauze. Hot bichloride (1 to 1000) dressing. Fowler position.

Result: Patient's recovery rapid and uneventful, gradual disappearance of pus from urine and wound; of discomfort in right hypochondriac region. Fistula at end of second month.

Second operation: Lumbar incision parallel with last rib on right side, including and cutting out old drainage incision. Kidney separated with great difficulty from the surrounding tissues on account of previous inflammatory processes. It was finally dissected loose but incision had to be enlarged to about 17 cm. in length. The enlarged, purulent kidney was

excised. No attempt was made to dissect out the ureter. Wound closed. Patient stood the operation well.

Result: Good recovery. Patient voided voluntarily 6 hours after operation. The tube was removed on the third day and the packing on the fifth day. On the seventh day a small pus cavity above the drainage opening was evacuated. Incision looked well.

Pathological report: Smears made directly from the pus show Gram negative bacilli and Gram positive cocci. Cultures show colon bacilli and staphylococci. No tubercle bacilli.

Microscopical examination: Few kidney tubules and glomeruli scattered through a mass of fibrous tissue; there are small round cells and polymorphonuclear leucocytes. In many places masses of cells are in normal arrangement but show cloudy swelling and are surrounded by polymorphonuclear leucocytes in great abundance. The capsule of Bowman surrounding many of the glomeruli is much thickened. Blood vessels have thick fibrous walls.

Diagnosis: Suppurative pyelonephritis.

CASE 2396. *Diagnosis:* Renal calculus.

Operation: Nephrolithotomy.

Woman, 25 years of age. *Family history:* Very good.

Personal history: Only usual children's diseases. Since the present illness began she has had a great deal of pain in left kidney, with frequqent urinations. She has passed gravel and much pus.

Present illness: Began about 5 years ago with severe pain in the bladder, left side and back. She was treated for muscular rheumatism but did not improve.

Operation: Patient in right lateral position. Oblique incision and kidney exposed. The kidney was of normal size and appearance. The pelvis was opened and a large stone removed. A second stone was palpated but could not be extracted, so nephrectomy was done and the stone removed. The incision was closed with plain gut and the skin with silkworm gut.

Result: Recovery. No sinus after 4 weeks.

Nephrectomies for Infected Kidney Cases not Tuberculous

Operator	Reference	Diagnosis	Result
Bruns	Simon, Chir. der Nieren. 1876. ii, p. 54		Death. Collapse
Czerny	Centrall. f. Chir. 1879. No. 45	Pyonephrosis	Recovery
Cowper	Brit. M. J. 1880. ii, p. 850	Pyonephrosis	Recovery
Lange	Med. Rec. 1880. xviii, p. 144	Abscess	Death. Incapacity of other kidney
Bardenheuer	Cited by Newman p. 237 (1881)	Pyonephrosis	Recovery
Clementi	Ibid. (1881)	Pyonephrosis	Recovery
Czerny	Tr. Inter. M. Cong. 1881. 7th. Sess. Vol. ii.	Pyonephrosis	Recovery
Czerny	Tr. Inter. M. Cong. 1881. 7th. Sess. Vol. ii	Pyonephrosis	Recovery
Frattini	Cited by Newman p. 237 (1881)	Multiple abscesses	Death
Lucas	Tr. Inter. M. Cong. 1881, ii, 271	Sacculated kidney filled with suppurating cavities	Recovery
Bardenheuer	Cited by Newman p. 238 (1882)	Nephritic abscess	Recovery
D'Antonia	Ibid.	Pyonephrosis	Recovery
Marsh	Lancet, 1882 i, p. 648	Pyonephrosis	Death. Collapse
Tait	Brit. M. J. 1882 ii, p. 929	Pyonephrosis	Recovery
Vecchi	Cited by Newman p. 238 (1882)	Pyonephrosis	Recovery
V. Bergmann	Ibid. (1883)	Pyonephrosis	Death
Elder	Ibid. (1883)	Acute suppurative nephritis	Death. Fatty degeneration of the other kidney
Palmer	Med. News 1883. xlii, 547	Pyonephrosis	Death
West	Lancet, 1883. i, p. 424	Pyonephrosis	Recovery
Whitehead	Brit. M. J. 1883. i, p. 1226	Pyonephrosis	Death. Shock
V. Bergmann	Cited by Newman p. 239 (1884)	Pyonephrosis	Recovery
V. Bergmann	Cited by Newman p. 239 (1884)	Pyonephrosis	Recovery
D'Antona	Lancet, 1884. ii, p. 1055	Pyonephrosis	Death. Collapse
Weir	Cited by Newman p. 239	Pyonephrosis	Death. Shock
Bardenheuer	Cited by Newman p. 240 (1885)	Pyelitis	Recovery
V. Bergmann	Ibid. (1885)	Pyonephrosis	Recovery
Bogue	Chic. M. J. & Exam. 1885. li, p. 45	Sacculated kidney; compartments distended with pus	Recovery
Lucas Championnière	Cited by Newman p. 240 (1885)	Pyonephrosis	Recovery

Nephrectomies for Infected Kidney Cases not Tuberculous—*Cont.*

Operator	Reference	Diagnosis	Result
Clementi	Ibid. (1885)	Pyonephrosis	Death
Gardner	Austr. M. J. 1885. iv, 15	Abscess	Death. Degeneration of other kidney
Iterson	Cited by Newman p. 240 (1885)	Suppurating nephritis	Recovery
Leopold	Ibid. (1885)	Pyonephrosis	Recovery
McGill	Brit. M. J. 1885. ii, p. 67	Pyonephrosis	Death. Slipping of ligature
Ollier	Rev. de Chir. 1885. v, 849	Pyonephrosis	Recovery
Polaillon	Med. News. 1885. xlvi, 692	Pyelonephritis	Recovery
Robson	Cited by Newman p. 239 (1885)	Renal cyst containing grumous matter	Death. Acute mania
Tait	Ibid. (1885)	Multiple abscesses	Death. Shock
Tait	Ibid. (1885)	Disorganization of kidney	Recovery
Trélat	Ibid. (1885)	Pyonephrosis	Death
Verneuil	Ibid. (1885)	Suppurating hydronephrosis	Death. Failure of other kidney
Vincenzo	Ibid.	Pyonephrosis	Recovery
Malherbe	Gaz. Méd. de Nantes 1885–6. lv, p. 123	Pyelonephritis	Recovery
Lucas Championnière	Cong. Fr. de Ch. 1886. ii, p. 132	Pyelonephritis	Recovery
Lucas Championnière	Cong. Fr. de Ch. 1886. ii, p. 132	Suppurating nephritis	Death. Shock
Clementi	Cited by Newman p. 241 (1886)	Pyonephrosis	Recovery
Lange	Med. News. 1886. xlviii, p. 69	Pyonephrosis	Recovery
Lange	Ibid. xlix, 695	Pyonephrosis	Recovery
Legoud	Cited by Newman p. 241 (1886)	Suppurating hydronephrosis	Recovery
Owen	Ibid. (1886)	Chronic suppuration	Recovery
Segond	Cong. Fr. de Chir. 1886. ii, p. 189	Suppurating hydronephrosis	Recovery
Malherbe	Gaz. Méd. de Nantes 1886–87. v, p. 5	Abscess	Recovery
Péraire	Soc. Anat. de Paris 1887. lxii, p. 88	Suppurating hydronephrosis	Recovery
Strange & Owen	Lancet, 1887.-i, p. 1282	Chronic Renal Abscess	Recovery
Knie	St. Petersb. M. Wch. 1888. n. F. v, 317	Echinococcus of kidney	Recovery
Thiriar	Rev. de Chir. 1888. viii, p. 197	Abscess	Recovery
Thiriar	Rev. de Chir. 1888. viii, p. 197	Suppurative nephritis	Recovery

Nephrectomies for Infected Kidney Cases not Tuberculous—*Cont.*

Operator	Reference	Diagnosis	Result
Weinlechner	Brit. M. J. 1888. i, p. 763	Pyonephrosis	Recovery
Woodbury	J.A.M.A. 1888. x, p. 308	Pyonephrosis	Death. Exhaustion
Heurtaux	Gaz. d. Hôp. Paris 1889. lxii, p. 962	Pyelonephritis	Recovery
Irish	Bos. M. & S. J. 1889. cxxxi, p. 560	Pyonephrosis	Recovery
Thornton	Tr. Med. Chir. Soc. 1889. lxxii, p. 312	Pyonephrosis	Recovery
Thornton	Tr. Med. Chir. Soc. 1889. lxxii, p. 312	Pyonephrosis	Recovery
Thornton	Tr. Med. Chir. Soc. 1889. lxxii, p. 312	Pyonephrosis	Death. Injury to vena cava
Thornton	Tr. Med. Chir. Soc. 1889. lxxii, p. 312	Pyonephrosis	Recovery
Thornton	Tr. Med. Chir. Soc. 1889. lxxii, p. 312	Pyonephrosis	Recovery
Thornton	Tr. Med. Chir. Soc. 1889. lxxii, p. 312	Pyonephrosis	Death. Exhaustion
Monod	Soc. de Chir. 1890. xvi, 208	Pyelonephritis	Recovery
Elliott	Bos. M. & S. J. 1891. cxxiv, 457	Pyonephrosis	Recovery
Fowler	N. Y. M. J. 1891. liii, 215	Pyonephrosis	Recovery
Fowler	N. Y. M. J. 1891. liii, 215	Suppurating hydronephrosis	Recovery
Quénu	Soc. de Chir. 1891. xvii, 533	Intermittent pyonephrosis	Recovery
Terrillon	Ibid. 1891. xvii, 101	Suppurating polycystic kidney	Recovery
Dubar	Ann. Org. G. U. 1892. x, 604	Pyonephrosis	Recovery
Graves	Med. News 1892. lxi, 602	Pyonephrosis	Recovery
Lockwood	Lancet 1892. i, 694	Pyonephrosis	Recovery
Page	Ibid. 1893. i, 997	Pyonephrosis	Recovery
Page	Ibid. 1893. i, 997	Pyonephrosis	Recovery
Sullivan	J. A. M. A. 1892. xviii, 38	Pyonephrosis	Recovery
Briddon	Ann. of Surg. 1893. xvii, 318	Pyonephrosis	Recovery. Sinus
Bartlett	Lancet 1894. ii, 1350	Pyonephrosis	Recovery
Israel	Erfahrungen über Nierenchir 1894	Pyonephrosis	Recovery
Israel	Erfahrungen über Nierenchir 1894	Pyonephrosis	Recovery
Israel	Erfahrungen über Nierenchir 1894	Pyonephrosis	Recovery
Israel	Erfahrungen über Nierenchir 1894	Infected hydronephrosis	Recovery
Israel	Erfahrungen über Nierenchir 1894	Infected hydronephrosis	Recovery

Nephrectomies for Infected Kidney Cases not Tuberculous—*Cont.*

Operator	Reference	Diagnosis	Result
Israel	Erfahrungen über Nierenchir 1894	Infected hydronephrosis	Recovery
Israel	Erfahrungen über Nierenchir 1894	Infected hydonephrosis	Recovery
Israel	Erfahrungen über Nierenchir 1894	Nephritis with military abscesses	Recovery
Weir	Tr. Am. Sur. Ass. 1894. xii, 121	Pyonephrosis, military abscesses	Recovery
Bartlett	Lancet, 1895. i, 675	Pyonephrosis & intestinal obstruction	Recovery
Ainsley	Brit. M. J. 1895. i, 1440	Suppurating kidney	Recovery
Briddon	Ann. of Surg. 1895. xxi, 65	Abscess	Recovery
Knox	Glasgow M. J. 1895. xliv, 139	Pyonephrosis & cyst degeneration	Recovery
Means, W. J.	Col. M. J. 1895. xv, 355	Pyonephrosis	Recovery
Thornton	Lancet 1895. i, 211	Pyonephrosis	Recovery
Thornton	Lancet 1895. i, 211	Pyonephrosis	Recovery
Thornton	Lancet 1895. i, 211	Pyonephrosis	Recovery
Woodward	Ann. of Surg. 1895. xxi, 568	Acute Pyonephritis	Recovery
McBurney	Ibid. 1896. xxiii, 282	Abscess	Recovery
Brauninger	Beit. Z. klin. Chir Bd. 18. 1897. p. 461	Pyonephrosis	Death
Brauninger	Beit. Z. klin. Chir. Bd. 18. 1897. p. 461	Pyonephrosis	Recovery
Brauninger	Beit. Z. klin. Chir Bd. 18. 1897. p. 461	Pyonephrosis	Recovery
Brauninger	Beit. Z. klin. Chir Bd. 18. 1897. p. 461	Pyonephrosis	Recovery
Coelho	Rev. de Chir. 1897. xvii, 891	Suppurating pyelonephritis	Recovery
Coelho	Rev. de Chir. 1897. xvii, 891	Suppurating pyelonephritis	Recovery
Coelho	Rev. de Chir. 1897. xvii, 891	Suppurating pyelonephritis	Recovery
Homans	Bos. M. & S. J. 1897. cxxxvii, 547	Renal abscess & Calculus pyelitis	Recovery
Leplat	J. d. Sc. méd. de Lille, 1897. i. 42	Pyonephrosis	Recovery
Noble	Ann. of Surg. 1897. xxv, 190	Pyonephrosis	Recovery
Tuffier	Comptes rendus du 12e. Cong. Inter. de Méd. Moscow 1897 p. 208	Pyelonephritis	Recovery
Tuffier	Comptes rendus du 12e. Cong. Inter. de Méd. Moscow 1897. p. 208	Pyelonephritis	Recovery
Tuffier	Comptes rendus du 12e. Cong. Inter. de Méd. Moscow 1897 p. 208	Pyelonephritis	Recovery

Nephrectomies for Infected Kidney Cases not Tuberculous—*Cont.*

Operator	Reference	Diagnosis	Result
Carstens	J. A. M. A. 1898. xxx, 1506	Pyonephrosis	Recovery
Martin	Brit. M. J. 1898. i, 1142	Pyonephrosis	Recovery
Weir	Med. News 1898. lxxii, 76	Multiple abscesses	Recovery
Weir	Med. News 1898. lxxii, 76	Multiple abscesses & Cyst	Death
Johnson A. B.	Ann. of Surg. 1899. xxix, 10, 218	Suppurating abscess	Recovery
Johnson A. B.	Ann. of Surg. 1899. xxix, 10, 218	Abscess	Recovery
Johnson A. B.	Ann of Surg. 1899. xxix, 10, 218	Abscess	Recovery
Johnson A. B.	Ann. of Surg. 1899. xxix, 10, 218	Multiple abscesses	Recovery
Johnson A. B.	Ann of Surg. 1899. xxix, 10, 218	Abscess	Recovery
Johnson A. B.	Ann. of Surg. 1899. xxix, 10, 218	Pyonephrosis	Sinus
Johnson A. B.	Ann. of Surg. 1899. xxix, 10, 218	Pyonephrosis	Sinus
Webster	Montreal M. J. 1899. xxviii, 600	Pyonephrosis	Recovery
Souligoux	Soc. Anat. de Paris 1900, lxxv, 790	Pyonephrosis	Recovery
Pousson	Soc. de Chir. 1901. xxvii, 689	Bacillus Coli infection	Recovery
Pousson	Soc. de Chir. 1901. xxvii, 689	Suppurating nephritis	Death. Other kidney filled with purulent urine
Deaver	Ann. of Surg. 1902 xxxvi, 87	Pyonephrosis	Recovery
Deaver	Ann. of Surg. 1902. xxxvi, 87	Pyonephrosis	Recovery
Deaver	Ann. of Surg. 1902. xxxvi, 87	Pyonephrosis	Recovery
Ducheni	J. d. Sc. méd. de Lille. 1902. i, 106	Pyonephrosis	Recovery
Housel	Soc. de Chir. 1902. xxviii, 568	Pyonephrosis	Recovery
Johnson, A.	Ann. of Surg. 1902. xxxv, 402	Acute pyelonephritis	Recovery
Ladinski	Med. Rec. 1902. lxi, 212	Acute Suppuration	Recovery
Pluyette	Soc. de Chir. 1902. xxviii, 827	Hydatid cyst	Recovery
Wiener	Med. Rec. 1902. lxi, 724	Abscess	Recovery
Becker	Clevel. M. J. 1903. ii, 468	Abscess	Recovery
Young	Johns' Hopk. Hosp. Bull. 1903. xiv–96	Pyonephrosis-typhoid bacillus in pure culture	Recovery

Nephrectomies for Infected Kidney Cases not Tuberculous—*Cont.*

Operator	Reference	Diagnosis	Result
Kapsammer	Wien. klin. Wch. 1904. xviii, 515	Infection	Recovery
Kelly	Am. J. of Obst. 1904. l, 857	Infarction from infection	Recovery
LeFur	Ann. Org. G. U. 1904. xxii, 1745	Pyonephrosis	Recovery
Panier	J. d. Sc. méd. de Lille 1904. i, 216	Pyonephrosis	Recovery
Krotoszyner	Am. J. Urol 1904–05. i, 297	Pyonephrosis	Recovery
Abbott	Northwest. Lan. 1905. xxv, 34	Pyonephrosis	Recovery
Abbott	Northwest. Lan. 1905. xxv, 34	Pyonephrosis	Recovery
Hessert	Ann. of Surg. 1905. xli, 792	Metastatic renal abscesses	Recovery
Holmes	Inter. J. of Surg. 1905. xviii, 99	Suppurating kidney	Recovery
Vander Veer	Tr. Am. Sur. Ass. 1905. xxiii, 19	8 Abscess kidneys	1 Death. 7 Recoveries
Watson	Med. & Sur. Rep. Bos. C. Hosp. 1905. p. 106	Pyonephrosis	Recovery
Barling	Ann. of Surgery 1906. xliii, 413	Pyelonephritis	Recovery
Barling	Ann. of Surgery 1906. xliii, 413	Pyonephrosis	Recovery
Barling	Ann. of Surgery 1906. xliii, 413	Pyonephrosis	Recovery
MacArthur	Ibid. 1906. xliv, 627	Pyonephrosis	Recovery
Peck	Ibid. 1906. xliv, 619	Colon bacillus infected kidney	Recovery
Hofmeister	Deutsche M. Wch. 1907. ii, 1845	Pyelitis	Recovery
Kummell	Surg. Gyn. & Obst. 1907. iv, 21	37 Pyonephrotic cases	5 Deaths. 32 Recoveries
Tédenat	Ann. Org. G. U. 1907. xxv, 1215	Suppurating gonococcic nephritis	Recovery
Vance	Louisv. Mo. J. M. & S. 1907–08. xiv, 277	Movable kidney with active infection	Recovery
Warren	Post-Grad. 1907. xxii, 517	Suppurating kidney (Dr. Cabot's case)	Recovery
Alexander	Ann. of Surg. 1908, xlvii, 612	Abscess	Recovery
Brewer	Am. J. of Med. Sci. 1908. cxxxv, 625	18 Pyonephrotic nephrectomies	18 Recoveries
Brewer	Am. J. of Med. Sci. 1908. cxxxv, 625	Pyelonephritis	Recovery
Brewer	Am. J. of Med. Sci. 1908. cxxxv, 625	8 Acute septic infarcts	8 Recoveries

Nephrectomies for Infected Kidney Cases not Tuberculous—*Cont.*

Operator	Reference	Diagnosis	Result
Brewer	Am. J. of Med. Sci. 1908. cxxxv, 625	8 Acute septic infarcts	8 Recoveries
Cobb	Bos. M. & S. J. 1908. clviii, 226	Colon Bacillus infection	Recovery
Cobb	Bos. M. & S. J. 1908. clviii, 226	Colon Bacillus infection	Recovery
Cobb	Bos. M. & S. J. 1908. clviii, 226	Colon Bacillus infection	Recovery
Crowell	Kan. C. Med. Index Lan. 1908. xxxi, 357	Acute unilateral hæmatogenous infection	Recovery
Frazier	Tr. Am. Sr. Ass. 1908. xxvi, 644	Pyonephrosis	Recovery
Kirchner	Interstate M. J. 1908. xv, 933	Pyonephrosis	Recovery
Küster	Cit. in Watson & Cunningham's "G. U." Diseases p. 157	143 Suppurating pyelonephritis	24 Deaths. 119 Recoveries
Legueu	Soc. de Chir. 1908. xxxiv, 276	Pyonephrosis	Recovery
Miller	Am. J. of Obst. 1908. lviii, 313	Pyonephrosis	Recovery
Schmieden	Cit. by Watson & Cunningham, p. 156	87 Suppurating kidneys	24 Deaths. 63 Recoveries
Woolsey	Ann. of Surg. 1908. xlviii, 148	Abscess	Recovery
Mathews	Ibid. 1909. xlix, 541	Multiple infarcts	Recovery
Bull	Arch. f. klin. ch. 1910. xci, 745	Infected cystic kidney	Recovery
Hayes	Am. J. Derm. & G. U. Dis. 1910. xiv, 1	Pyonephrosis	Recovery
Richardson	Ibid. 1910. xiv, 153	Abscess	Recovery
Collica	N. Y. M. J. 1911. xliv, 376	Pyonephrosis	Recovery
Collica	N. Y. M. J. 1911. xliv, 376	Unilateral pyelonephritis	Recovery
Collica	N. Y. M. J. 1911. xliv, 376	Unilateral pyelonephritis	Recovery
Bristow	N. Y. State J. of M. 1911. vii, 369	Acute Unilateral hæmatogenous infection	Recovery
Bristow	N. Y. State J. of M. 1911. vii, 369	Multiple abscesses	Recovery
O'Farrell	Dub. J. M. Sc. 1911. cxxx, 397	Pyonephrosis	Recovery
Straus	MÜnch. M. Wch. 1911. lviii, 1047	Infected hydronephrosis	Recovery
Thompson	Ann. of Surg. 1911. liv, 355	Suppurating horseshoe kidney Removal of left diseased part	Recovery
Lower, W. E.	Published for the first time	Multiple septic infarcts	Recovery
Lower, W. E.	Published for the first time	Pyonephrosis	Recovery
Lower, W. E.	Published for the first time	Pyonephrosis	Recovery

Nephrectomies for Infected Kidney Cases not Tuberculous—*Cont.*

Operator	Reference	Diagnosis	Result
Lower, W. E.	Published for the first time	Pyonephrosis	Recovery
Lower, W. E.	Published for the first time	Pyonephrosis	Recovery
Lower, W. E.	Published for the first time	Pyonephrosis	Recovery
Lower, W. E.	Published for the first time	Pyonephrosis	Recovery
Lower, W. E.	Published for the first time	Pyonephrosis	Recovery

Nephrotomies for Infected Cases not Tuberculous

Operator	Reference	Diagnosis	Result
Bryant	Lancet. 1870. ii, p. 13	Renal Suppuration	Death from peritonitis
Andrew & Callender	St. Barth. Hos. Rept. 1873. ix, p. 211	Renal Suppuration	Fistula
Maclaren	Cited by Newman. p. 230, (1876)	Abscess	Fistula
Marshall	Ibid.	Abscess	Death
Courvoisier	Ibid. (1877)	Suppurating kidney	Death from peritonitis
Lange	Ibid.	Pyonephrosis	Recovery
Quincke	Ibid.	Pyonephrosis	Recovery
Bryant	Ibid. (1878)	Pyelitis	Recovery
Habershon	Ibid. (1879)	Suppuration	Recovery
Macewen	Ibid.	Abscess	Recovery
Post	N. Y. M. J. 1879. xxix, 64	Suppuration	Fistula
Golding-Bird	Cited by Newman. p. 231. (1880)	Suppuration	Recovery
Pusey	Lancet, 1880. i, p. 203	Abscess	Fistula
Waelle	Cited by Newman. p. 231. (1880)	Suppuration	Fistula
Baker	Tr. Inter. M. Cong. 1881. vii, p. 262	Large dilated kidney. Pus in evacuated fluid	Fistula
Baker	Tr. Inter. M. Cong. 1881. vii, p. 262	Sacculated kidney with pus-secreting cavities	Secondary Nephrectomy
Duncan	Cited by Newman. p. 232. (1881)	Suppuration	Fistula
Golding-Bird	Ibid.	Pyonephrosis	Recovery
Maclaren	Ibid.	Abscess	Fistula
Reliquet	Ibid.	Purulent Hydronephrosis	Recovery
Bundy	Bos. M. & S. J. 1882. cvi, p. 483	Pyonephrosis	Fistula
Leopold	Cited by Newman. p. 232. (1882)	Pyonephrosis	Death
Richardson	Bos. M. & S. J. 1882. cvi, p. 491	Pyonephrosis	Fistula

Nephrotomies for Infected Cases not Tuberculous—*Cont.*

Operator	Reference	Diagnosis	Result
Bergman	Cited by Newman. p. 238. (1883)	Pyonephrosis	Secondary Nephrectomy
Czerny	Ibid. p. 239. (1883)	Pyonephrosis	Secondary Nephrectomy
Czerny	Ibid. p. 239. (1883)	Pyonephrosis	Secondary Nephrectomy
Marshall	Ibid. p. 232. (1883)	Pyonephrosis	Recovery
Barker	Ibid. p. 232. (1884)	Pyelitis	Recovery
Cabot, A. T.	Ibid.	Pyonephrosis	Fistula
Gardner	Ibid.	Abscess	Recovery
Gardner	Ibid.	Suppuration	Recovery
Imlach	Ibid.	Pyonephrosis	Recovery
Renton	Ibid.	Pyonephrosis	Death
Wright	Med. News. 1884. xliv, p. 51	Pyonephrosis	Death
Barker	Cited by Newman. p. 234. (1885)	Gonorrhœal Pyelitis	Recovery
Buchanan	Ibid.	Pyonephrosis	Death
Ferreri	Ibid.	Pyelonephritis	Recovery
Knaggs	Brit. M. J. 1885. i, 432	Pyelonephritis	Recovery
Labbé	Cited by Newman p. 233. (1885)	Suppuration	Death
Lloyd	Ibid.	Nephritic Abscess	Fistula
Miller	Ibid.	Pyonephrosis	Recovery
Taylor	Ibid.	Renal Abscess	Recovery
Van Iterson	Lancet, 1885. ii, p. 1137	Suppuration	Secondary Nephrectomy
Wasdin	Rep. Sup. Surg. Mar. Hos. 1885–6. p. 155.	Pyonephrosis	Secondary Nephrectomy
Clark	Brit. M. J. 1886. i, 397	Nephritic Abscess	Fistula
Duncan	Cited by Newman. p. 234. (1886)	Abscess	Fistula
Goodel	Cited by Newman. p. 234. (1886)	Pyonephrosis	Recovery
Maclaren	Ibid.	Suppuration	Fistula
Neve	Lancet. 1886. i, 201	Suppuration	Death
Rawdon	Cited by Newman. p. 234. (1886)	Abscess	Death. Other kidney diseased
Reliquet	Ibid.	Abscess	Fistula
Sadler	Lancet. 1886. i, 919	Suppuration	Fistula
Taylor	Cited by Newman. p. 234. (1886)	Pyonephrosis	Recovery

Nephrotomies for Infected Cases not Tuberculous—*Cont.*

Operator	Reference	Diagnosis	Result
Wasdin	Rept. U. S. Marine Hos. 1886	Pyonephrosis	Secondary Nephrectomy
Belfield	Med. Rec. 1887. xxxi, 537	Pyoneprhosis	Recovery
Cheever	Bos. M. & S. J. 1887. cxvii, 7	Pyonephrosis	Fistula
Edel	Arch f. klin. Chir. 1887. xxxiv, 423	Suppurating kidney	Fistula
Kiely	Cinc. Lancet-Clinic 1887. xviii, 723	Suppurating Nephritis	Fistula
Lang	N. Y. M. J. 1887. xlv, p. 244	Pyonephrosis	Secondary Nephrectomy
Miller	Edin. M. J. 1887–8. xxxiii, 1068	Pyonephrosis	Death
Miller	Edin. M. J. 1887–8. xxxiii, 1068	Pyonephrosis	Fistula
Agnew	Med. News. 1888. lii, 115	Suppurating Pyelonephritis	Recovery
Danforth	Chic. M. J. & Exam. 1888. lvii, 74	Pyonephrosis	Fistula. Death in 2 weeks from Acute Nephritis
Danforth	Chic. M. J. & Exam. 1888, lvii, 74	Pyonephrosis	Recovery
Danforth	Chic. M. J. & Exam. 1888. lvii, 74	Pyonephrosis	Death
Danforth	Chic. M. J. & Exam. 1888. lvii, 74	Multiple Abscesses	Recovery
Homans	Bos. M. & S. J. 1888. cvxiii, 453	Abscess of the Kidney	Secondary Nephrectomy
Barker	Lancet, 1889. i, 419	Gonorrhœal Pyelitis	Recovery
Barker	Lancet, 1889, i, 419	Nephritic Abscess	Recovery
Gay	M. & S. Rept. Bos. City Hosp. 1889. 4, s. p. 217	Pyonephrosis	Fistula
Thornton	Tr. Med. Chir. Soc. 1889. lxxii, 312	Pyonephrosis	Secondary Nephrectomy
Barling	Lancet. 1890. ii, 873	Pyonephrosis of left Kidney Latent calculi in right	Death
Barling	Lancet. 1890. ii, 873	Pyelitis	Pain gone, blood & pus in urine. Frequent micturition
Braun	Arch. f. klin. Ch. 1890. Bd. 40. p. 923	Pyonephrosis	Secondary Nephrectomy
Braun	Arch. f. klin. Ch. 1890. Bd. 40. p. 923	Pyonephrosis	Death
Hamilton	N. Y. M. J. 1890. lii, 170	Suppurating Kidney	Fistula
Long, T. W.	Inter. J. Surg. 1890. iii, 103	Hydro-pyonephrosis	Death
Coley	N. Y. M. J. 1891. liii, 475	Pyelonephritis	Recovery
Juettner	Inter. J. S. 1891. iv, 208	Acute Suppurating Nephritis	Recovery

Nephrotomies for Infected Cases not Tuberculous—*Cont.*

Operator	Reference	Diagnosis	Result
Kammerer	Med. Rec. 1891. xxxix, 368	Pyonephrosis	Secondary Nephrectomy
Davidson	Liverpool Med. Chir. J. 1892. xii, 252	Abscess	Secondary Nephrectomy
Guyon	Ann. Org. G. U. 1892. x, 573	Pyonephrosis	Recovery
Page	Lancet 1893. i, 997	Pyonephrosis	Secondary Nephrectomy
Richardson	Bos. M. & S. J. 1893. cxxviii, 357	Abscess	Secondary Nephrectomy
Guyon	Ann. Org. G. U. 1894. xii, p. 4444	Pyonephrosis	Recovery
Guyon	Ann. Org. G. U. 1894. xll, p. 603	Pyonephrosis	Recovery
Israel	Erfahrungen über Nieren-chir. 1894	Pyonephrosis	Death
Israel	Erfahrungen über Nieren-chir. 1894	Pyonephrosis	Recovery
Israel	Erfahrungen über Nieren-chir. 1894	Pyonephrosis	Fistula
Israel	Erfahrungen über Nieren-chir. 1894	Pyonephrosis	Recovery
Israel	Erfahrungen über Nieren-chir. 1894	Pyonephrosis	Fistula
Israel	Erfahrungen über Nieren-chir. 1894	Infected Hydronephrosis	Recovery
Israel	Erfahrungen über Nieren-chir. 1894	Pyonephrosis	Death
Israel	Erfahrungen über Nieren-chir. 1894	Infected Hydronephrosis	Recovery
Israel	Erfahrungen über Nieren-chir. 1894	Pyonephrosis	Secondary Nephrectomy
Israel	Erfahrungen über Nieren-chir. 1894	Pyonephrosis	Secondary Nephrectomy
Israel	Erfahrungen über Nieren-chir. 1894	Pyonephrosis	Secondary Nephrectomy
Israel	Erfahrungen über Nieren-chir. 1894	Pyonephrosis	Secondary Nephrectomy
Israel	Erfahrungen über Nieren-chir. 1894	Pyonephrosis	Secondary Nephrectomy
Israel	Erfahrungen über Nieren-chir. 1894	Abscess	Secondary Nephrectomy
Fleming	Glasgow M. J. 1895. xliv, 134	Pyonephrosis	Fistula
Thornton	Lancet. 1895. i, 211	12 cases of Suppurating Kidneys	1 Death. 11 Recoveries
Viers	Ann. Org. G. U. 1895. xiii, 827	Pyonephrosis	Recovery

Nephrotomies for Infected Cases not Tuberculous—*Cont.*

Operator	Reference	Diagnosis	Result
Woodward	Ann. of Surg. 1895. xxi, 568	Chronic Pyelonephritis	Secondary Nephrectomy
Woodward	Ann. of Surg. 1895. xxi, 568	Chronic Pyelonephritis	Secondary Nephrectomy
Woodward	Ann. of Surg. 1895. xxi, 568	Chronic Pyelonephritis	Secondary Nephrectomy
Albarran	Rev. de Chir. 1896. xvi, 882	Pyonephrosis	Death
Albarran	Rev. de Chir. 1896. xvi, 882	8 Pyonephrotic Kidneys	8 Recoveries
Dice	Inter. J. of S. 1896. x, 196	Pyelonephritis	Recovery
Newman	Glasgow M. J. 1896. xlvi, 11	Pyonephrosis	Fistula
Norris	Amer. Gyn. & Obst. J. 1896. ix, 288	Pyelitis	Recovery
Tally	Ibid. 1896. ix, 284	Pyonephrosis	Fistula
Way	Med. News. 1896. lxix, 351	Pyelitis	Recovery
Friedman	Ber. klin. Wch. 1897. i, 260	Pyelitis	Recovery
Tuffier	Comptes-rendus de 12 Cong Intern. du Méd. Moscow, 1897. p. 208	17 Nephrotomies for Pyelonephritis	6 Recoveries. 5 Fistulæ. 6 Deaths
Tuffier	Comptes-rendus de 12 Cong Intern. du Méd. Moscow 1897. p. 208	Pyelonephritis	Secondary Nephrectomy
Bloch	Rev. de Chir. 1898. xviii, 481	Pyonephrosis	Recovery
Bloch	Rev. de Chir. 1898. xxxx, 10	Pyelonephritis	Recovery
Doyen	Ibid. p. 1060	Pyonephrosis	Recovery
Phocas	Ibid. p. 1067	Pyonephrosis	Fistula
Phocas	Ibid. p. 1067	Pyonephrosis	Fistula
Reynier	Ibid. p. 1058	Suppurating Polycystic Kidney	Death
Reynier	Ibid. p. 1058	Pyonephrosis	Death
Reynier	Ibid. p. 1058	Suppurating Polycystic Kidney	Death
Reynier	Ibid. p. 1058	Kidney Hydronephrosis	Secondary Nephrectomy
Reynier	Ibid. p. 1058	Kidney Hydronephrosis	Secondary Nephrectomy
Reynier	Ibid. p. 1058	Kidney Hydronephrosis	Secondary Nephrectomy
Tuttle, Reynolds & Ogden	Bos. M. & S. J. 1898. cxxxviii, 174	? Kidney	Secondary Nephrectomy
Weir	Med. News. 1898. lxxii, 76	Pyelonephritis	Recovery
Weir	Med. News. 1898. lxxii, 76	Pyonephrosis	Recovery

Nephrotomies for Infected Cases not Tuberculous—*Cont.*

Operator	Reference	Diagnosis	Result
Freeman	N. Y. M. J. 1899. xxx, 587	Abscess	Fistula
Freeman	N. Y. M. J. 1899. xxx, 587	Suppurating Nephritis	Recovery
Johnson	Ann. of Surg. 1899. xxxx, 10	Abscess	Fistula
Johnson	Ann. of Surg. 1899. xxxx, 10	Abscess	Fistula
Johnson	Ann. of Surg. 1899. xxxx, 10	Suppurating Kidney	Recovery
Johnson	Ann. of Surg. 1899. xxxx, 10	Suppurating Kidney	Recovery
Johnson	Ann. of Surg. 1899. xxxx, 10	Suppurating Kidney	Fistula
Johnson	Ann. of Surg. 1899. xxxx, 10	Abscess	Fistula
Johnson	Ann. of Surg. 1899. xxxx, 10	Abscess	Recovery
Johnson	Ann. of Surg. 1899. xxxx, 10	Hydro-pyonephrosis	Fistula
Johnson	Ann. of Surg. 1899. xxxx, 10	Pyonephrosis	Fistula
Johnson	Ann. of Surg. 1899. xxxx, 10	Pyonephrosis	Death
Johnson	Ann. of Surg. 1899. xxxx, 10	Pyonephrosis	Death. Other kidney congested
Johnson	Ann. of Surg. 1899. xxxx, 10	Pyonephrosis	Fistula
Johnson	Ann. of Surg. 1899. xxxx, 10	Renal colic & Pyuria	Recovery
Lauwers	Ann. Org. G. U. 1899. xvii, 876	Pyonephrosis	Secondary Nephrectomy
Lyman	Tr. Col. M. Soc. 1899. p. 278	Suppuration	Fistula
Ransohoff	Tr. Am. Surg. Ass. 1899. xvii, 161	Abscess	Recovery
Ransohoff	Tr. Am. Surg. Ass. 1899. xvii, 161	Pyonephrosis	Recovery
Ransohoff	Tr. Am. Surg. Ass. 1899. xvii, 161	Suppurating Kidney	Death
Ransohoff	Tr. Am. Surg. Ass. 1899. xvii, 161	Infected Kidney. Sinus discharged two and one half years after nephrotomy	Secondary Nephrectomy
Stewart	Lancet. 1899. ii, 1436	Abscess	Recovery
Walker	Iowa M. J. 1899. v, 327	Suppurating Pyelonephritis	Death
Blake	Bos. M. & S. J. 1901. cxlv, 66	Abscess	Recovery
Cabot, A. T.	Ibid. 1901. cxliv, 554	Colon Bacillus abscess	Recovery
Keon	Dom. Monthly 1901. xvi, 127	Pyonephrosis	Recovery

Nephrotomies for Infected Cases not Tuberculous—*Cont.*

Operator	Reference	Diagnosis	Result
Loison	Soc. de Chir. 1901. xxvii, 1182	Suppurating Pyelonephritis	Secondary Nephrectomy
Pousson	Ibid. 1901. xxvii, 689	Acute Infection	Recovery
Pousson	Ibid. 1901. xxvii, 689	Colon Bacillus Infection	Recovery
Wiener	Med. Rec. 1902. lxi, 724	Pyelonephritis	Secondary Nephrectomy
MacArthur	Ann. of Surg. 1903. xxxvii, 968	Suppurative Pyonephrosis	Fistula
Besley	Ibid. 1904. xl, 289	Pyonephrosis	Secondary Nephrectomy
Besley	Ibid. 1904. xl, 289	Pyonephrosis	Recovery
Dzierne	Monatsb. f. Urol. 1904. ix, 136	Pyonephrosis & Abscesses	Death
Dzierne	Monatsb. f. Urol. 1904. ix, 136	Pyonephrosis & Abscesses	Anuria
Dzierne	Monatsb. f. Urol. 1904. ix, 136	Pyonephrosis & Abscesses	Recovery
Dzierne	Monatsb. f. Urol. 1904. ix, 136	Pyonephrosis & Abscesses	Recovery
Dzierne	Monatsb. f. Urol. 1904. ix. 136	Pyonephrosis & Abscesses	Recovery
Dzierne	Monatsb. f. Urol. 1904. ix, 136	Pyonephrosis & Abscesses	Fistula
Dzierne	Monatsb. f. Urol. 1904. ix, 136	Pyonephrosis & Abscesses	Fistula
Dzierne	Monatsb. f. Urol. 1904. ix, 136	Echinococcus in Pyonephrosis	Recovery
Dzierne	Monatsb. f. Urol. 1904. ix, 136	Echinococcus in Pyonephrosis	Recovery
Dzierne	Monatsb. f. Urol. 1904. ix, 136	Pyonephrosis	Recovery
Kraus	Deutsch. M. Wch. 1904. xl, 1060	Primary Diphtheria	Recovery
McCosh	Tr. N. Y. Surg. Soc. Oct. 26, 1904	Abscess	Recovery
Singly	Amer. Med. 1904. viii, 244	Pyonephrosis	Secondary Nephrectomy
Abbott	Northwest Lancet 1905. xxv, 34	Colon Bacillus Infection	Secondary Nephrectomy
Allen	Am. J. of Med. Sc. 1905. cxxix, 447	Chronic Pyelitis	Recovery
Chetwood	Phys. & Surg. 1905. xxvii, 289	Nephrotomy for Abscess & pus. Continued destruction of substance by suppuration	Secondary Nephrectomy
Chetwood	Phys. & Surg. 1905. xxvii, 289	Nephrotomy for Abscess & pus. Continued destruction of substance by suppuration	Secondary Nephrectomy

Nephrotomies for Infected Cases not Tuberculous—*Cont.*

Operator	Reference	Diagnosis	Result
Hartmann	Soc. de Chir. 1905. xxxii, 278	Pyuria	Recovery
Lange	N. Y. M. J. 1905. p. 244	Pyonephrosis	Secondary Nephrectomy
VanderVeer	Tr. Am. Surg. Ass. 1905. xxxii, 278	9 Nephrotomies for abscess	9 Secondary Nephrectomies
VanderVeer	Tr. Am. Surg. Ass. 1905. xxxii, 278	14 Nephrotomies for abscess	1 Death. 1 Fistula. 11 Recoveries. One still in ill health from secondary pelvic abscesses
Watson	M. & S. Reports Bos. C. Hos. 1905. p. 106	Pyonephrosis	Recovery
Adams	Ann. of Surg. 1906. xliii, 787	Gonococcic Infection	Secondary Nephrectomy
Barr & Goldstein	Tex. St. M. J. 1906–7, ii, 300	Suppuration	Secondary Nephrectomy
Lambert	Soc. de Chir. 1906. xxxii, 278	Pyuria	Recovery
Lydston, G.	J. A. M. A. 1906. xlvii, 1911	Pyelonephritis	Recovery
Lydston, G.	J. A. M. A. 1906. xlvii, 1911	Pyonephrosis	Secondary Nephrectomy
Lydston, G.	J. A. M. A. 1906. xlvii, 1911	Pyonephrosis	Secondary Nephrectomy
Stackhouse	Ibid. 1906. xliv. 1170	Pyonephrosis	Recovery
Hofmeister	Deutsch. M. Wch. 1907. ii, 1845	Pyelitis	Secondary Nephrectomy
Hofmeister	Deutsch. M. Wch. 1907. ii, 1845	Pyelitis	Recovery
Hummel	Surg. Gyn. & Obst. 1907. iv, 21	30 Nephrotomies for Pyonephrosis	4 Deaths. 26 Recoveries No permanent improvement
Hummel	Surg. Gyn. & Obst. 1907. iv, 21	6 Suppurating Kidneys	6 Secondary Nephrectomies
Leusman	Ill. M. J. 1907. xi, 128	Abscess	Recovery
Suter & Hagenbach	Cor. Bl. für schw. Aerzte. 1907. xxxvii, 457	Pyonephrosis	Secondary Nephrectomy
Brewer	Am. J. of Med. Sci. 1908. cxxxv, 625	6 Nephrotomies for Pyonephrosis	6 Recoveries
Brewer	Am. J. of Med. Sci. 1908. cxxxv, 625	14 Septic Infarcts	5 Deaths. 9 Recoveries
Brewer	Am. J. of Med. Sci. 1908. cxxxv, 625	2 Pyelonephritis	2 Recoveries
Brewer	Am. J. of Med. Sci. 1908. cxxxv, 625	1 large Cortical Abscess	Recovery
Cobb	Bos. M. & S. J. 1908. clviii, 226	Septic Infarcts	Recovery

Nephrotomies for Infected Cases not Tuberculous—*Cont.*

Operator	Reference	Diagnosis	Result
Küster	Cited by Watson & Cunningham. 1908. p. 157	100 Nephrotomies for Suppurating Pyelonephritis	17 Deaths. 23 Secondary Nephrectomies. 60 Recoveries
Weisswange	Münch. M. Wch. 1908. lv, 967	Abscess	Recovery
Fairchild	J. A. M. A. liv, 2103	Suppurating Kidney	Recovery
Morris	Lancet 1910, i, 1597	Suppurating Kidney	Secondary Nephrectomy
Pringle	Dublin J. of M. Sc. 1901. cxxx, 399	Pyonephrosis	Recovery. Pain & pus continues
Pringle	Dublin J. of M. Sc. 1910. cxxx, 399	Pyonephrosis	Recovery. Pain & pus continues
Richardson	Johns Hopkins Hos. Bull. 1910. xxi, 80	Abscess	Recovery
Watson	Bos. M. & S. J. 1910. clxiii, 942	16 yrs. ago Nephrostomy for Pyonephrosis of l. kidney & fistula established. 9 yrs. later acute infection of rt. kidney & permanent drainage established	Fistula
Cotton	Ann. of Surg. Nov. 11,1911	Hæmatogenous Infection	Recovery
Cotton	Ann. of Surg. Nov. 11,1911	Hæmatogenous Infection	Recovery
Furness	Am. J. of Obst. 1911. liv, 282	Hæmatogenous Infection	Secondary Nephrectomy
Langmead	Brit. J. Child. Dis. 1911. viii, 207	Acute Pyelitis in baby	Death
Martin	Ann. of Surg. 1911. liii, 423	Suppurating Nephritis	Fistula
Pringle	Practitioner 1911. lxxxvii, 35	Pyelonephritis	Recovery. Pus & Bacilli continue in urine
Lower, W. E.	Pub. for the first time	Suppurating Pyelonephritis	Secondary Nephrectomy
Lower, W. E.	Pub. for the first time	Pyonephrosis	Recovery. Probably no secreting substance left
Lower, W. E.	Pub. for the first time	Pyonephrosis	Death from general infection

Nephrectomies for Infected Calculous Cases

Operator	Reference	Diagnosis	Result
Simon	Chir. der Nieren ii, p. 148	Calculous Pyelitis	Death. Pyæmia
Peters	N. Y. M. J. 1872. xvi, 473	Calculous Pyelitis	Death
Muller	Cited by Newman p. 272 (1878)	Calculous Pyelitis	Recovery
Bardenheuer	Ibid. (1879)	Calculous Pyelitis	Recovery
Urbaniti	Ibid. (1879)	Calculous Pyelitis	Death
Barker	Ibid. (1880)	Calculous Pyelitis	Death. Collapse
Barker	Ibid. (1880)	Calculous Pyelitis	Death. Other kidney diseases
Cowper	Med. Times & Gaz. 1880. ii, 588	Calculous Pyonephrosis	Recovery
M'Clelland	Cited by Newman p. 273. (1880)	Calculous Pyelitis	Fistula
Stockwell	Ibid. (1880)	Calculous Pyelitis	Death. Hæmorrhage from renal vein
Barwell	Tr. of Lond. Cong. 1881. ii, 275	Calculous Abscess	Recovery
Bardenheuer	Cited by Newman p. 273 (1881)	Calculous Pyonephrosis	Recovery
Czerny	Ibid. (1881)	Calculous Pyonephrosis	Death
Péan	Ibid. (1881)	Calculous Pyelitis	Recovery
Richet	Ibid. (1881)	Calculous Pyonephrosis	Recovery
Godlee	Lancet, 1882. i, 648	Calculous Pyelitis	Death
Rosenbach	Ber. klin. Wch. 1882. p. 65	Calculous Pyelitis	Recovery. Fistula
Baker	Brit. M. J. 1883. i, 123	Calculous Pyelitis	Recovery
Bergman	Cited by Newman p. 274 (1883)	Calculous Pyelitis	Death
D'Antona	Ibid. (1883)	Calculous Pyonephrosis	Recovery
Ollier	Ibid. (1883)	Calculous Pyelitis	Recovery
Wright	N. Y. M. J. 1883. xxxvii, 178	Chronic Pyelitis with stone	Recovery
Bobroff	Cited by Newman p. 276 (1884)	Calculous Pyelitis	Recovery
Bottini	Ibid. (1884)	Calculous Pyelitis	Recovery
Elder	Ibid. (1884)	Calculous Pyelitis	Recovery
Kosinski	Ibid. (1884)	Interstitial nephritis & stone	Recovery
MacEwen	Brit. M. J. 1884. i, 123	Calculous Abscesses	Recovery
Salamoni	Cited by Newman p. 275 (1884)	Calculous Pyelitis	Recovery
Tait	Ibid. (1884)	Hydronephrosis	Recovery
Billroth	Wien. M. Wch. 1885. xxxv, 985	Calculous Pyelonephritis	Death. Hæmorrhage
Colquhoun	Lancet, 1885. i, p. 1081	Calculous Pyelitis	Recovery

Nephrectomies for Infected Calculous Cases—*Cont.*

Operator	Reference	Diagnosis	Result
Edis	Cited by Newman p. 276 (1885)	Calculous Pyonephrosis	Recovery
LeDentu	Ibid. (1885)	Calculous Pyelitis	Death
LeDentu	Ibid. (1885)	Calculous Pyelitis	Recovery. Fistula
Péan	Ibid. (1885)	Calculous Pyelitis	Death
Péan	Ibid. (1885)	Calculous Pyelitis	Recovery
Polaillon	Ibid. (1885)	Calculous Pyelitis	Recovery
Savage	Ibid. (1885)	Calculous Pyonephrosis	Recovery
Shepherd	Med. Rec. 1885. xxviii, 645	Calculous Pyelitis	Recovery
Trélat	Bull. Soc. Chir. 1885. i, 895, 826	Calculus & Cystic disease	Recovery
Walsham	Brit. M. J. 1885. i, 895	Calculus & Pus	Recovery
Briddon	Med. News 1886. xlviii, 130	Calculous Abscess	Death. Other kidney diseased
Edis	Cited by Newman p. 277. (1886)	Calculous Pyonephrosis	Death
Godlee	Ibid. (1886)	Calculous Pyonephrosis	Recovery
Macewen	Ibid. (1886)	Calculous Pyonephrosis	Recovery
Maclaren	Cited by Newman p. 277 (1886)	Calculous Pyelitis	Recovery
Marsh	Ibid. (1886)	Atrophied calculous kidney	Recovery
Périer	Ibid. (1886)	Calculous Pyelitis	Death
Shepherd	Med. News 1886. xlvii, 525	Calculous Pyelitis	Recovery
Czerny	Ber. klin. Wch. 1887.p. 777	Calculous Pyonephrosis	Recovery
Péraire	Bull. Soc. Anat. 1887. v, 62	Suppurating Hydronephrosis	Recovery
Terrier	Rev. de Chir. 1887. vii, 342	Calculous Pyelitis	Recovery
MacCann	Tr. Amer. Surg. Ass. 1888. vi, 524	Calculous Abscess	Death. Other kidney diseased
Thornton	Tr. Med. Chir. Soc. 1889. lxxii, 312	Calculous Pyelitis	Death. Other kidney in same condition
Thornton	Tr. Med. Chir. Soc. 1889. lxxii, 312	Calculous Pyelitis	Recovery
Thornton	Tr. Med. Chir. Soc. 1889. lxxii. 312	Calculous Pyelitis	Death. Hemiplegia
Thornton	Tr. Med. Chir. Soc. 1889. lxxii, 312	Calculous Pyonephrosis	Recovery
Thornton	Tr. Med. Chir. Soc. 1889. lxxii, 312	Calculous Pyonephrosis	Recovery
Menocal	Lancet, 1890. ii, 136	Calculous Pyonephrosis	Recovery
Markoe	N. Y. M. J. 1891. liii, 312	Calculous Pyonephrosis	Recovery
Reclus	Ann. Org. G. U. 1891. lx, 185	Calculous Pyonephrosis	Recovery

Nephrectomies for Infected Calculous Cases—*Cont.*

Operator	Reference	Diagnosis	Result
Simons	Med. News 1891. lix, 655	Calculous & Suppurating nephritis	Recovery
Cushing	Bos. M. &. S. J. 1892. cxxvii, 257	Calculous Pyelonephritis	Recovery
Dörfler	Münch. Med. Wch. 1893. p. 549	Calculous Abscess	Recovery
Hume	Lancet, 1893. i, 196	Calculous Pyonephrosis	Recovery
Israel	Erfahrungen über Nierenchir, 1894	Calculous Pyonephrosis	Death
Israel	Erfahrungen über Nierenchir, 1894	Calculous Pyonephrosis	Recovery
Israel	Erfahrungen über Nierenchir, 1894	Calculous Pyonephrosis	Recovery
Israel	Erfahrungen über Nierenchir, 1894	Calculous Pyonephrosis	Recovery
Mynter	Med. Rev. 1894. xlvi, 732	Nephrolithiasis & Pyonephrosis	Recovery
Ainsley, F	Brit. M. J. 1895. i, p. 1440	Calculous Pyonephrosis	Recovery
Knox	Glasgow M. J. 1895. xliv, 134	Calculous Pyonephrosis	Recovery
Park, R.	Inter. Clinic 1896. 6 s. ii, 191	Calculous Pyelitis	Recovery
Thornton	Lancet, 1895. i, 211	Calculous Pyelitis	Recovery
Reaton	Brit. M. J. 1896. i, 534	Calculous Pyelitis	Recovery
Rovsing, T.	Arch. f. klin. Chir. 1896. li, 827	Suppurating Nephrolithiasis	Death. Effects of narcotics
Rovsing, T.	Arch. f. klin. Chir. 1896. li, 827	Calculous Pyuris	Recovery
Adenot	Lyon Méd. 1897. lxxxiv, 52	Calculous Pyonephrosis	Recovery
Duret	Ann. Org. G. U. 1897. xv, 350	Calculous Pyonephrosis	Recovery
Myles	Edin. M. J. 1897. ii, 209	Calculous Pyelonephrosis	Death. Shock
Depage	Ann. Soc. Belge de Chir. 1898–99. vi, 278	Calculous Pyonephrosis	Recovery
Harajewicz	Rev. de Chir. 1898. xviii, 275	Lithopyonephrosis	Recovery
Litten	Ber. klin. Wch. 1898. p. 983	Calculous Pyonephrosis	Death. Other kidney diseased
Weir	Med. News 1898. lxxii, 76	Calculous Pyelonephritis	Recovery
Weir	Med. News 1898. lxxii, 76	Calculous & pus, complete atrophy of kidney	Recovery
Johnson	Ann. of Surg. 1899. xxlx, 10	Calculous Pyonephrosis	Death. Shock
Johnson	Ann. of Surg. 1899. xxlx, 10	Calculous Abscess	Recovery
Johnson	Ann. of Surg. 1899. xxlx, 10	Calculous Cyst	Recovery
Doran	Tr. M. Soc. London 1900–01. xxiv, 98	Calculous Pyonephrosis	Recovery

Nephrectomies for Infected Calculous Cases—*Cont.*

Operator	Reference	Diagnosis	Result
Thumin	Ber. klin. Wch. 1900. xxxvii, 1003	Calculous Pyonephrosis	Recovery
Morris	Surg. of the Kidneys & Ureters 1901. ii, 275	29 Nephrectomies for calculus diseases	24 Recoveries. 5 Deaths
Ferguson, E.	J. A. M. A. 1902. xxxix, 8	Calculous Abscess	Recovery
Johnson, A.	Ann. of Surg. 1902. xxxv, 403	Calculous Pyonephrosis	Recovery
Ladinski	Med. Rec. 1902. lxi, 212	Calculous Pyelonephritis	Recovery
Young	Johns Hop. Hos. Bull. 1903. xiv, 94	Calculous Pyonephrosis	Recovery
McMurtry	Louisville, Mo. J. M. & S. 1904–05. xi, 247	Calculous Pyonephrosis	Recovery
Baldy	Amer. Med. 1905. ix, 271	Calculous Pyonephrosis	Recovery
Brown	Ann. of Surg. 1905. xli, 131	Calculous Pyonephrosis	Recovery
Chetwood	Phys. & Surg. 1905. xxvii, 289	Calculous Pyonephrosis	Recovery
Barling	Ann. of Surg. 1906. xliii, 413	Calculous Pyonephrosis	Recovery
Bazy	Soc. de Chir. 1906. xxxii, 670	Calculous Pyonephrosis	Recovery
Clark	Glasgow M. J. 1906. lxv, 45	Calculous Pyonephrosis	Recovery
Lydston, G.	J. A. M. A. 1906. xlvii, 1911	Calculous Pyonephrosis	Death. Oper. too long delayed
Chetwood	Tr. Amer. Gyn. Ass. 1907. xxxii, 247	Calculous Pyonephrosis	Recovery
Greaves, F.	Brit. M. J. 1907. ii, 75	Calculous pyonephrosis containing typhoid bacillus in pure culture	Recovery
Alexander	Ann. of Surg. 1908. xlvii, 612	Calculous Abscess	Recovery
Hanel	Charite Annalen 1908. xxxii, 372	Calculous Pyonephrosis	Recovery
Hanel	Charite Annalen 1908. xxxii, 372	Calculous Pyonephrosis	Recovery
Hanel	Charite Annalen 1908. xxxii, 372	Calculous Pyonephrosis	Recovery
Davis	Kent M. J. 1908–09. vii, 452	Calculous Pyonephrosis	Recovery
Johnson, A. B.	Ann. of Surg. 1910. li, 260	Calculous Pyonephrosis	Recovery
Fowler, H. A.	Tr. Am. Ass. G. U. Surgeons 1910. p. 35	Calculous Pyonephritis	Recovery
Milne	Brit. M. J. 1911. ii, 249	Calculous Pyelitis	Death. Collapse
Lower, W. E.	Published for the first time	Calculous Infection	Recovery
Lower, W. E.	Published for the first time	Calculous Infection	Recovery
Lower, W. E.	Published for the first time	Calculous Infection	Recovery
Lower, W. E.	Published for the first time	Calculous Infection	Recovery

Nephrectomies for Infected Calculous Cases—*Cont.*

Operator	Reference	Diagnosis	Result
Lower, W. E.	Published for the first time	Calculous Infection	Recovery
Lower, W. E.	Published for the first time	Calculous Infection	Recovery
Lower, W. E.	Published for the first time	Calculous Infection	Recovery

Nephrotomies in Infected Calculous Cases

Operator	Reference	Diagnosis	Result
Annandale	Edinb. M. J. 1869. xv, 21	Nephrotomy & freeing of pus, passage of stones per sinus	Recovery
Andrew & Callender	St. Barth. Hos. Rpt. 1873. ix, 220	Calculous and pus	Death
Ingalls	Cited by Newman. p. 262. (1873)	Calculous Pyelitis	Fistula
Baker	Ibid. (1874)	Calculous Pyelitis	Death
Dawson	Amer. J. Med. Sc. 1873. lxv, 279	Calculous Pyonephrosis	Death
Savoy	Cited by Newman. p. 262 (1876)	Renal Abscess	Recovery
Patterson	Ibid. (1877)	Calculous Pyelitis	Fistula
Cullingworth	Ibid. (1879)	Calculous Pyelitis	Death
Macewen	Ibid. (1879)	Calculous Pyonephrosis	Recovery
Cowper	Ibid. (1879)	Calculous Pyonephrosis	Death
Hooper-May	Lancet. 1880. ii, 6	Calculous Pyelitis	Death
Mynter	Cited by Newman. p. 263 (1880)	Calculous Pyelitis	Death fr. Pneumonia
Peterson	Ber. klin. Wch. 1880. xvii, 192	Calculous Pyelitis	Recovery
Rea	Cited by Newman. p. 263 (1880)	Calculous & Fistula	Recovery
Clegg	Ibid. (1881)	Calculous Pyelitis	Death. Other kidney incapacitated
Duncan	Ibid. (1881)	Calculous Pyelitis	Recovery
Macewen	Ibid. (1881)	Calculous Abscess	Recovery
Rosenberger	Tr. Inter. M. Cong. 1881. ii, 277	Calculous Pyonephrosis	Secondary Nephrectomy
Whipham	Cited by Newman. p. 263 (1881)	Calculous Pyelitis	Recovery
Bennett-May	Ibid. (1882)	Calculous Pyelitis	Relapse of pus in urine
Bundy-Ingalls	Bos. M. & S. J. cvi, 483	Calculous Pyelitis	Fistula
Day	Lancet. 1882. ii	Calculous Pyelitis	Fistula
Lloyd	Cited by Newman. p. 264. (1882)	Calculous Pyelitis	Recurrence of symptoms in 18 months
Thelen	Ibid. (1882)	Calculous Pyelitis	Fistula

Nephrotomies in Infected Calculous Cases—*Cont.*

Operator	Reference	Diagnosis	Result
Whipham	Tr. Clin. Soc. Lon. 1882. xv, 123	Calculous Pyelitis	Death
Golding-Bird	Cited by Newman p. 265 (1883)	Calculous Pyonephrosis	Fistula
Güterbock	Ibid. (1883)	Calculous Pyelitis	Death. Other kidney diseased
Hill	Ibid. (1883)	Renal Suppuration & calculous	Recovery
Jones	Brit. M. J. 1883. i, 1069	Calculous Pyelitis	Death
Bennett-May	Cited by Newman, p. 266. (1885)	Calculous Pyelitis	Death
Bennett-May	Cited by Newman, p. 266 (1885)	Calculous Pyelitis	Recovery
Barker	Ibid. (1885)	Sacculated Kidney	Fistula
Cullingsworth	Tr. Path. Soc. 1885. xxxvi, 278	Calculous Pyelitis	Death. Calculi in both ureters
Championnière	Cited by Newman p. 267 (1885)	Calculous Pyelitis	Death
Duncan	Ibid. (1885)	Calculous Pyelitis	Death. Calculus in other ureter
Hatch	Lancet, 1885. l, 15	Calculous Pyonephrosis	Recovery
Hatch	Lancet, 1885. l, 15	Calculous Pyonephrosis	Recovery
Hill	Lancet, 1885. l, 1081	Calculous Pyonephrosis	After 6 weeks urine again turbid with flocculent pus
Hitch	Cited by Newman. p. 265. (1885)	Calculous Pyelitis	Recovery
Lauenstein	Ibid. (1885)	Calculous Pyelitis	Recovery
Mollière	Ibid. (1885)	Calculous Pyelitis	Recovery
Nicholson	Brit. M. J. 1885. p. 445	Calculous Pyonephrosis	Fistula
Rouse	Tr. Clin. Soc. Lond. 1885. xviii, 210	Calculous Pyelitis	Recovery
Tiffany	Med. News 1885. xlvi, 569	Calculous Pyonephrosis	Recovery
Walsham	St. Barth. Hos. Rept. 1885. xxi, 121	Calculous Pyelitis	Death
Wright	Cited by Newman 1885. p. 265	Renal and biliary colic	Death
Wright	Cited by Newman 1885. p. 265	Renal and biliary colic	Recovery
Browne, L.	Brit. M. J. 1886. i, 820	Calculous Pyelitis	Death. "Heart clot"
Carter	Liverp. M. & C. J. 1886. vi, 480	Calculous Pyelitis	Recovery
Franks	Brit. M. J. 1886. ii, 1220	Calculous Pyelitis	After months still pus
Lange	Med. News 1886. xlviii, 69	Calculous Pyonephrosis of left kidney. Later came nephrotomy of right kidney because of obstruction of the ureter & at this time no urine in bladder, showing left kidney non-secreting	

Nephrotomies in Infected Calculous Cases—*Cont.*

Operator	Reference	Diagnosis	Result
Lauenstein	Arch. f. klin. Ch. xxxiv, 222 1886–87	Calculous Pyelitis	Recovery
LeFort	Cited by Newman p. 267 (1886)	Calculous Pyelitis	Death
Stone & Croft	Lancet 1886. i, 589	Calculous Pyelitis	Recovery
Walsham	Cited by Newman p. 268 (1886)	Calculous Pyelitis	Recovery
Agnew	Med. News 1887. i, 682	Calculous Pyonephrosis	Fistula
Chavasse	Lancet 1887. i, 408	Calculous Abscess	Death
Morris	Ibid. 1887. i, 270	Cysts filled with pus & calculi	Death. Other kidney diseased
Tiffany	Med. News 1887. 1, 428	Calculous Pyonephrosis	Recovery
Teal	Cited by Newman p. 268. (1887)	Renal Calculous	Death
Agnew	Med. News 1888. lii, 115	Calculous Pyonephrosis	Recovery
Hull	Lancet 1888. i, p. 119	Calculi thrice removed	Secondary Nephrectomy
Page	Brit. M. J. 1888. i, 795	Calculous Pyonephrosis	Recovery
Verrall	Brit. M. J. 1888. i, p. 356	Calculous Pyonephrosis	Fistula
Imlach	Ibid. 1889. i, p. 1225	Calculous Pyelonephritis	Recovery
Bellamy	Lancet 1890. ii, p. 339	Calculous Pyelitis	Recovery
Keetley	Ibid. 1890. i, p. 134	Suppurating calculous kidney	Recovery
Keetley	Ibid. 1890. i, p. 134	Suppurating calculous kidney	Fistula
Williams	Ibid. 1890. i, p. 643	Calculous Pyonephrosis	Fistula
Jacobson	Brit. M. J. 1891. i, p. 858	Calculous Pyonephrosis	Secondary Nephrectomy
Poirier	Th. Legueu 1891. p. 158	Calculous Pyelonephritis	Death
Footner	Brit. M. J. 1892. i, p. 69	Calculous Pyonephrosis	Recovery
Keen & Stewart	Ther. Gaz. 1892. xvi, p. 27	Calculous Pyelitis	Death. Other kidney incompetent
Cordier	Med. Rec. 1894. xlv, 332	Calculous Pyonephrosis	Recovery
Cordier	Med. Rec. 1894. xlv, 332	Calculous Pyonephrosis	Recovery
Israel	Erfahrungen über Nierenchir. 1894.	Calculous Pyonephrosis	Fistula
Briddon, C. K.	Ann. of Surg. 1895. xxi, p.29	Abscess	Secondary Nephrectomy
Kelly, H.	Med. News 1895. lxvii, p. 594	Calculous Pyonephrosis	Recovery
Kraus	Münch. Med. Wch. 1895. p. 1066	Calculous Pyonephrosis	Recovery
Thornton	Lancet, 1895. 11, 1041	Calculous Pyonephrosis	Recovery
Thornton	Lancet, 1895. 11, 1041	Calculous Pyonephrosis	Recovery, but in two months tube inserted through pus and urine came

Nephrotomies in Infected Calculous Cases—*Cont.*

Operator	Reference	Diagnosis	Result
Thornton	Lancet, 1895. 11, 1041	Calculous Pyonephrosis	Recovery
Fuller	J. Cut. & G. U. Dis. 1896. xiv, p. 146	Calculous Pyonephrosis	Secondary Nephrectomy
Lilienthal	Ann. of Surg. 1896. xxiii, 257	Calculous Pyonephrosis	Secondary Nephrectomy
Rovsing	Arch. f. klin. Chir. 1896. li, 827	Calculous Pyonephrosis	Recovery
Thornton	Lancet. 1896. 1, 92	Calculous Pyonephrosis	Recovery
Walker	J. A. M. A. 1896. xxvii, 1173	Calculous Pyonephrosis	Secondary Nephrectomy
Holmes	Ibid. 1897. xxviii, 680	Calculous Pyelitis	Recovery
Myles	Edin, M. J. 1897. 11, 209	Calculous & pus in urine	Recovery
Myles	Edin, M. J. 1897. 11, 209	Calculous Abscess	Recovery
Buchanan	Med. News 1898. lxiii, 306	Calculous Pyonephrosis	Recovery
Buchanan	Med. News 1898. lxiii, 306	Calculous Pyonephrosis	Secondary Nephrectomy
Phocas	Rev. de Chir. 1898. p. 1067	Calculous Pyonephrosis	Fistula
Stoner	Med. News 1898. lxiii, 622	Calculous Pyelitis	Death
Weir	Ibid. 1898. lxxii, 76	Calculous Pyonephrosis	Recovery
Weir	Ibid. 1898. lxii, 76	Calculous Pyelitis	Secondary Nephrectomy
Johnson	Ann. of Surg. 1899. xxiv, 10	Calculous Abscess	Death
Johnson	Ann. of Surg. 1899. xxiv, 10	Stones removed per sinus which had been discharging since an abscess was opened 3 yrs. before	Recovery
Johnson	Ann. of Surg. 1899. xxiv, 10	Pyuria & Calculi	Recovery
Johnson	Ann. of Surg. 1899. xxiv. 10	Calculous Pyelitis	Fistula
Jones	Brit. M. J. 1898. 1, 764	Calculous Pyonephrosis	Recovery
Lyman	Tr. Col. M. Soc. 1899. p. 278	Calculous Pyonephrosis	Secondary Nephrectomy
Whittaker	Bos. M. & S. J. 1899. cxl, 29	Calculous Pyonephrosis	Secondary Nephrectomy
Kraus	Ber. Klin. Wch. 1901. xxviii, 656	Calculous Pyonephrosis	Recovery
Riche	Soc. de Chir. 1901. xxvii, 689	Calculous Pyelonephritis	Secondary Nephrectomy
Riche	Ibid. 1902. xxviii, 1007	Calculous Pyonephrosis	Recovery
Charlton	Indiana, M. J. 1902–3. xxi, 97	Calculous Pyonephrosis	Secondary Nephrectomy
Van Meter	Inter. J. of Surg. 1903. xvl, 146	Calculous Pyonephrosis	Fistula
Young	Johns Hop. Hos. Bull. 1903. xiv, 94	Calculous Pyonephrosis	Recovery
Dzierne	Monat. f. Urol. 1904. ix, 136	Calculous Pyonephrosis	Recovery

Nephrotomies in Infected Calculous Cases—*Cont.*

Operator	Reference	Diagnosis	Result
Dzierne	Monat. f. Urol. 1904. ix. 136	Calculous Pyelitis & Abscess	Death. Hæmorrhage from Stomach
Dzierne	Monat. f. Urol. 1904. ix, 136	Calculous Pyonephrosis	Fistula
Cabot, F.	Post Grad. 1905. xx, 1272	Calculous Pyonephrosis	Fistula
Chetwood	Phys. & Surg. 1905. xxvii, 289	Calculous Pyonephrosis	Recovery
Nicolich	Ann. Org. G. U. 1905. xxiii, 361	Calculous Pyonephrosis	Recovery
Watson	Med. & Surg. Rept. Bos. C. Hos. 1905, p. 106	Infected Calculi	Recovery
Watson	Med. & Surg. Rept. Bos. C. Hos. 1905, p. 106	Infected Calculi	Recovery
Watson	Med. & Surg. Rept. Bos. C. Hos. 1905, p. 106	Infected Calculi	Recovery
Warren	Post Grad. 1907. xx, 517	Infected Calculi	Secondary Nephrectomy
Conant	Bos. M. & S. J. 1908. clviii, 224	Calculous Pyonephrosis	Recovery
Conant	Bos. M. & S. J. 1908. clviii, 224	Calculous Abscess	Recovery
Zuckerkandl	Arch. f. klin. Chir. 1908. p. 480	8 Nephrotomies for infected calculi	6 Recoveries. 2 Deaths
Blum & Ultzman	Zeit. f. Urol. 1909. p. 139	Calculous Pyelonephritis	Recovery
Sexton	Ill. M. J. 1909. xv, 111	Calculous Abscess	Fistula
Sexton	Ill. M. J. 1909. xv. 111	Calculous Abscess	Recovery
Sexton	Ill. M. J. 1909. xv, 111	Calculous Abscess	Secondary Nephrectomy
Clay	Lancet 1910. 1, p. 238	Calculous Pyonephrosis	Recovery
Fabricus	Zeits. f. Chir. 1911. cix, 617	2 Nephrotomies	Secondary Nephrectomy
Kusnetsky	Ztschr. f. Urol. 1911. v, 634	Calculous Hydro-pyonephrosis	Recovery
Lower, W. E.	Published for the first time	Renal Calculus	Recovery
Lower, W. E.	Published for the first time	Renal Calculus	Recovery
Lower, W. E.	Published for the first time	Renal Calculus	Convalescence of 5 months. Recovery